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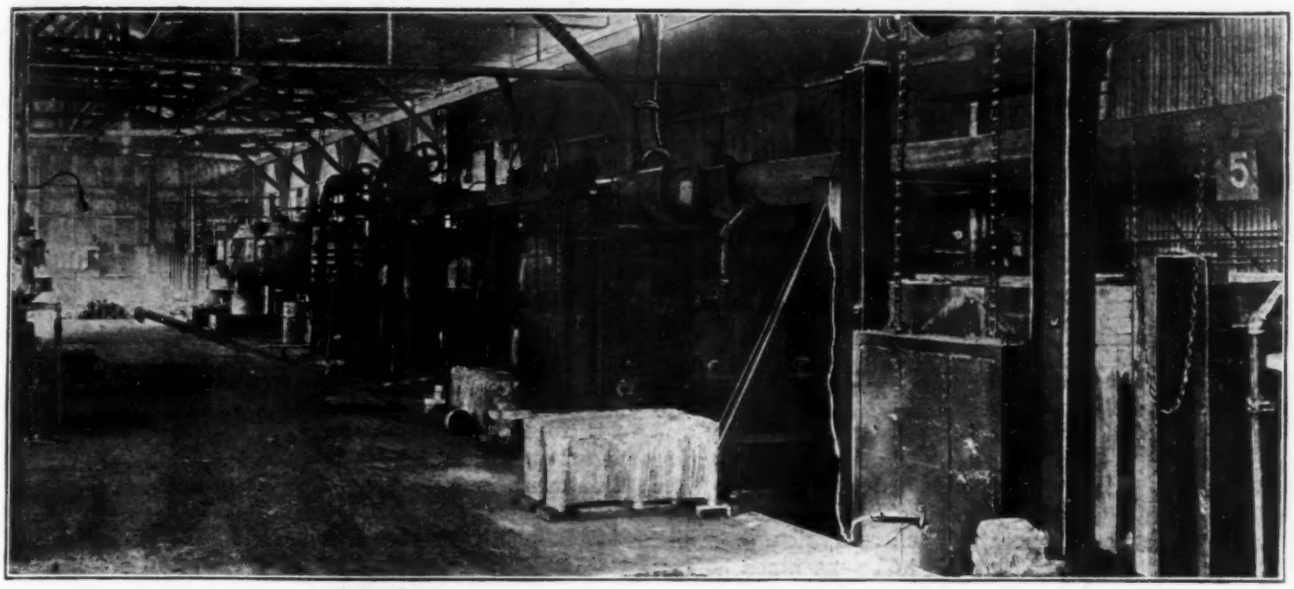


FIG. 1—THE CARBURIZING ROOM AND FURNACES

Heat Treating in a California Tractor Plant

SPECIAL CORRESPONDENCE

Illustrations of the equipment used, its capacity, and the work done — The steels used, the fuels and the way in which work is handled

THE importance of heat treating parts for tractors is keenly recognized by the C. L. Best Tractor Co., San Leandro, Calif., as can be seen by the illustrations from its heat treating department. The principal steels used in the work are alloy steels Nos. 2315, 2335 and 2345 and S.A.E. carbon steels Nos. 1020, 1035 and 1045.

The following list of equipment will give an idea of the extent of this department and also show that no expense has been spared to make it first class in every particular. The sizes given are the approximate outside dimensions, not including the steel frames, and the capacities are the extreme capacity per furnace, being determined by the size and form of the work, and the temperature required:

Six carburizing furnaces as shown in Fig. 1. These furnaces are, 8 ft. square and have a capacity of from 450 to 1,500 lb. per 24-hr. day for each furnace. Samples are run in each box, and are broken and inspected before the work in the box is released to the shop.

One double-track car annealing-furnace 6x21 ft. This furnace contains two sets of five cars, each set travelling in opposite directions. Each car is 18x46 in. The capacity is from 3 to 4 tons per 24-hr. day.

Four reheating furnaces of the semi-muffle type, Fig. 2. These furnaces are 6½ ft. square and have a capacity of from 500 to 2,000 lb. per 8-hr. day.

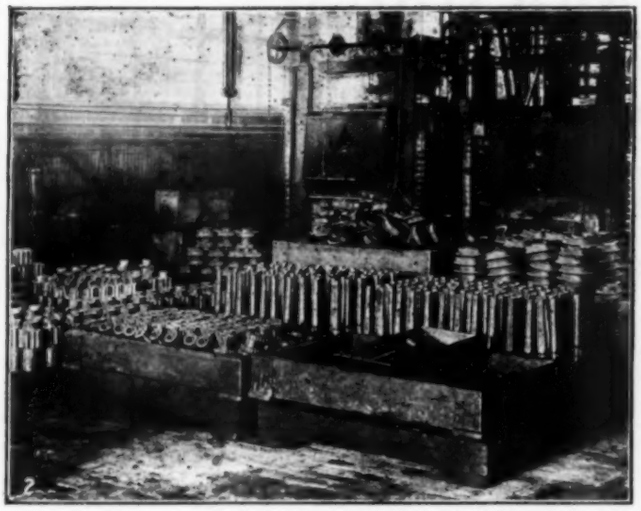
Three rotary-hearth furnaces 10 ft. in diameter, Fig. 3. Capacity is from 400 to 550 track links per day, or from 2,000 to 3,000 lb. This view also shows the trays used and the way in which they are stacked for trucking.

Special furnace for sprockets; capacity 12 to 18 sprockets per 8-hr. day.

One "hump" electric furnace 36 in. in diameter by 36 in high.

Three drawing pots, 4 ft. in diameter. The total capacity of these pots is sufficient to handle all of the work that requires drawing, from all of the above furnaces.

Also there are four smaller furnaces for special work.



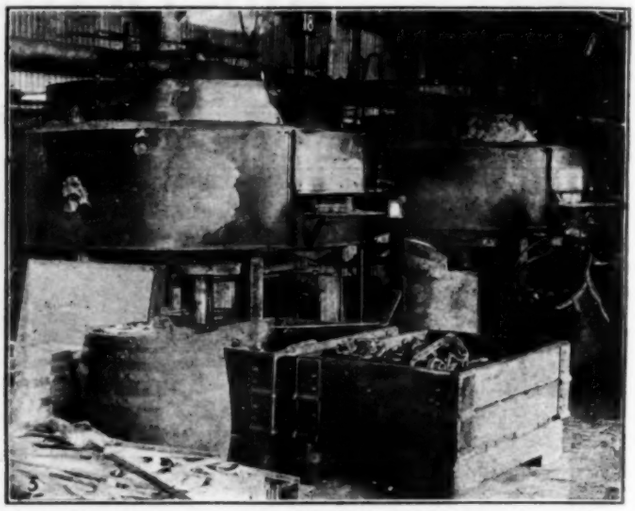


FIG. 2—REHEATING FURNACES. FIG. 3—ROTARY FURNACES FOR TRACK LINKS

The larger furnaces are all fired with preheated oil, but some of the smaller furnaces are heated by gas or electricity. The air supply is furnished by a pair of General Electric Co. centrifugal compressors. The choice of fuel or heating method has been decided by the accuracy of temperature control which the work required, whether the work is to be machined or not, the intensity and duration of the heat, and, of course, the cost per unit of the final output of sufficient quality. Control here refers to rapid and accurate changes of temperature. For small quantities, or batch processes, electric heat is often better. For long steady heat, oil is satisfactory. The rotary furnaces are held within 20 deg. F. limits. Preheated oil is fuel oil heated to a point below the flash point, before using, to secure better combustion.

Parts in the rough are either normalized or annealed, and in some cases both. Normalizing consists of heating considerably above the critical temperature of the particular steel being handled, and cooling freely in air. It is usually preparatory to further heat treatment. Some parts are normalized and then quenched and drawn, completing the entire heat treatment before being machined. The hardness of pieces to be machined depends on the analysis of the steel and subsequent operations. The maximum hardness of work which is to be machined after heat treatment is from 241 to 285 Brinell. The minimum hardness, which is, of course, on low carbon steel machined after heat treatment, is from 156 to 187 Brinell. In some operations the steel works better when it is from 187 to 217 Brinell than when it is softer.

With the exception of a very small amount of cyaniding, which is all done in one pot furnace, 8 in. in diameter and 10 in. deep, carburizing is done by packing in boxes with the covers luted in place, some of these boxes being shown in Fig. 4. The steels used for carburizing are S.A.E. 1020 and S.A.E. 2315. The maximum holding-heats range from 1,600 to 1,720 F., depending upon the steel, the form of the piece and the purpose for which it is to be used. The heating schedules are specified for a fixed rate of increase during the warming up to the maximum, and are held uniformly at the maximum for a definite time. The heat is controlled by a very complete pyrometer equipment, every furnace having a temperature measuring instrument of some kind. Some furnaces have their individual indicators, where they are not closely grouped. But the greater number of furnaces are connected to a Leeds & Northrup indicating potentiometer, and can also be connected to recording instruments for checking purposes. Each of the rotary hardening

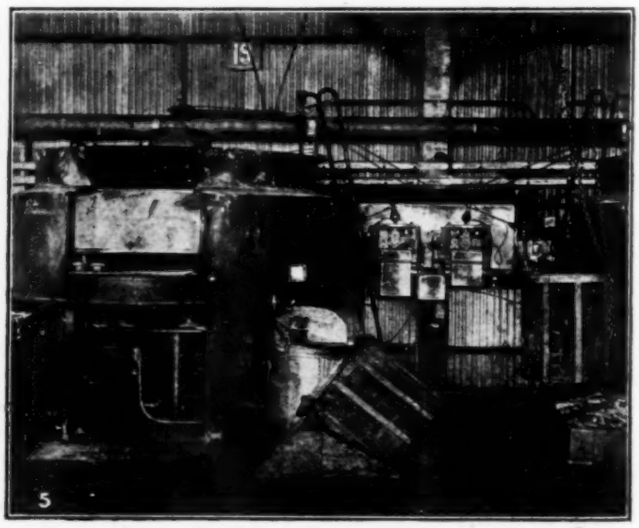


FIG. 4—THE CARBURIZING BOXES. FIG. 5—RECORDING INSTRUMENTS ON ROTARY FURNACES

furnaces shown in Fig. 5 is controlled by a recording instrument of the same make, which gives automatic regulation within less than 10 deg. F. Fig. 5 also shows the wire baskets used for quenching and the stand by which they can be held in an inclined position for easy loading.

The carburizing material is chemically energized charcoal made from peach pits. The heating time varies from 6 to 24 hr., depending on the parts being treated and the size of the boxes. The time allowed for cooling in the boxes is usually 8 hr. or more. All the work is cooled in the boxes and then single or double quenched afterwards, according to requirements. Many sections are heavy enough, so that a single quench gives the required quality in the case, with ample strength and desired hardness of core.

High-analysis steels, such as S.A.E. 1035, 1045, 2335, and 2345, are heated above their critical temperatures and quenched in oil or water. They are then drawn back in oil or molten salts in the draw pots. Or, if the temperatures are above a red heat and when scale is not objectionable, the drawing is done in open furnaces, otherwise in the electric furnace.

The "hump" electrical furnace of the Leeds & Northrup Co. is used exclusively for gears and tool work. The charge of gears is lowered into the furnace in one batch and kept covered until ready to quench, there being no circulation of air or furnace gases during this time, nor is any inspection necessary. The pyrometer temperature recorder writes a story of the changes going on in the steel and gives notice when the charge should be quenched. This is made possible by the fact that the temperature of the pyrometer couple is controlled by the steel being heated, and not directly by the furnace temperature. Incidentally, the chart gives a permanent record of the work and makes it easily possible to duplicate any required treatment without error and with minimum supervision.

Proper quenching is an important item in connection with the use of this type of furnace on account of the large mass being quenched at one time. The large mass makes it absolutely necessary to have a rapid circulation and uniform temperature of the quenching liquid, so these factors must be controlled as well as the temperature of the work.

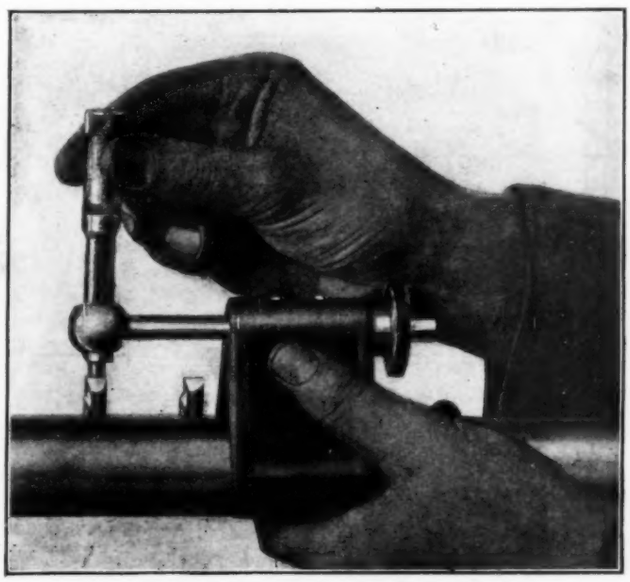
After heat treatment, the carburized work tests as high as 90 on the scleroscope and resists the file. Parts made of high alloys, such as gears, are given a maximum Brinell hardness of 555, or about 80 on the scleroscope. The minimum hardness for alloy bolts and for some shafts is 302 Brinell, or about 50 scleroscope, when these parts are to be treated after machine work has been done upon them.

The Brinell machine is used for testing hardness wherever the form and size or the class of the work permits its use. The scleroscope is used on the general run of carburized work, or where the other method is not feasible. The file is used on the small quantity of cyaniding work done and in a preliminary sorting of abnormal, carburized lots.

Gage for Setting Boring-Bar Cutters—Discussion

By F. W. Elstub
Alfred Herbert, Ltd., Coventry, England

There appeared on page 635, Vol. 58, of the *American Machinist*, an article under the above title by I. B. Rich, which describes a gage used by the Pierce-Arrow Motor Car Co., Buffalo, N. Y., for setting single-point boring-bar cutters. This gage is almost identical with one designed by Alfred Herbert, Ltd., Coventry, many years ago. It was found to have one disadvantage, however: When two cutters were set in the same bar within about 2½ in. of each other, the gage in some cases could not be used on one of the cutters.



GAGE FOR SETTING CUTTER IN BARS

An improved design is shown herewith. In this, the micrometer head is adjustable and can be used on a cutter about 2 in. away from the body. The sliding bar is keyed in the body and is clamped by the knurled collar at the back. This collar is split in three places and screws into the body until a taper seat tightens it on the sliding bar.

The micrometer head is a standard 1-in. ratchet-type. The method of using is as follows: Measure the boring bar and subtract the diameter from the required size of hole. Half the remainder gives the projection of the cutter from the bar. Set the gage with the micrometer touching the bar. Take the reading and then withdraw the micrometer to the required projection and set the cutter to just touch the micrometer. The body must be held firmly in contact with the boring bar.

For example, it is required to bore a hole 3 in. in diameter plus 0.005 minus nothing, with a 2⅛-in. bar.

Actual diameter of boring bar	2.124 in.
Actual hole required	3.005 in.
Half difference	0.4405 in.
Reading with micrometer touching bar	0.058 in.
Reading with micrometer touching cutter	0.4985 in.

It will be noted that in the above example the cutter has been set to give the maximum hole. The reason for this is that as soon as the cutter starts work it will begin to wear and such a setting gives the longest life to the cutter before resetting becomes necessary. It is the practice of many mechanics to set their tools in the middle of the tolerance allowed, but this is a mistake as a little thought will show.

Formulas for Helical Gears

By V. L. Sherman

AT THE Lewis Institute in Chicago we are in the habit of using the formulas for helical gears published by the *American Machinist*, but in the classes in gear design we find that helical gearing is much better understood, and that a better grasp of the formulas is acquired, if the theoretical spur gear equivalent is shown to the students.

The following solution was developed some time ago in class and does not involve any higher mathematics than geometry. The problem is to prove

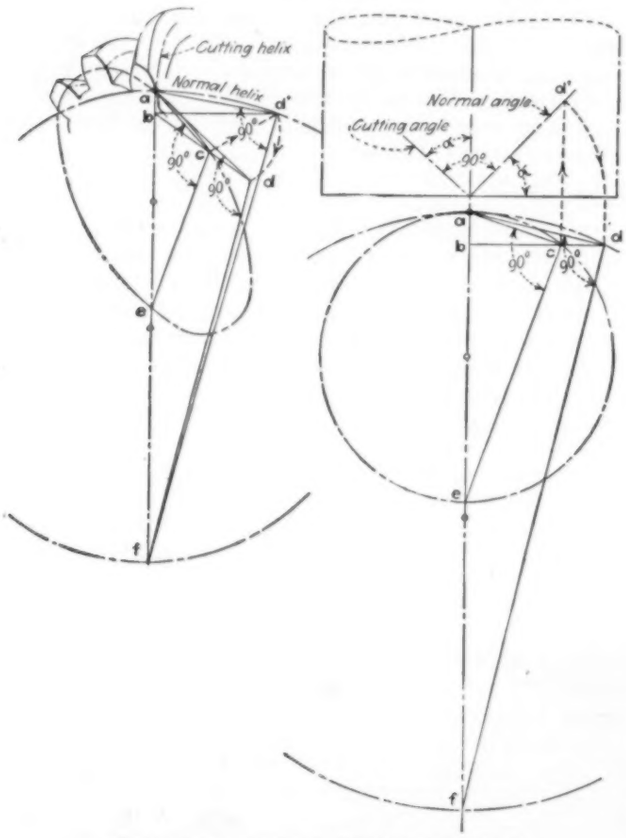
$$N' = \frac{N}{\cos^3 \alpha}$$

in which, N = number of teeth in the helical gear

N' = number of teeth in the theoretical spur gear equivalent, used in determining the number of the cutter

α = helix angle.

Inspection of the geometric construction in the figure will indicate that the action of the tooth at the



GEOMETRIC CONSTRUCTION FOR SPUR GEAR EQUIVALENT

instant of contact is taken at the point of intersection of two helices, one in the tooth of the gear and the other normal to it. A spur gear which would be equivalent to the helical gear would lie along the normal helix at the pitch point and have the same radius as the normal helix.

In the construction diagram *ae* is laid off proportional to the pitch diam. of the helical gear in question. A right triangle is drawn between the points *a*, *e* and an assumed point *c* on the pitch circle. Point *c* is then projected to the normal helix, along the pitch cylinder and parallel to the axis, giving the point *d'*.

A perpendicular erected on *ad'* at the point *d'* will intersect the extension of *ae* at *f* and form a right triangle *adf*. For convenience this triangle is shown rotated into the same plane as the triangle *ace*, in which position the point *d'* is designated *d*.

From the similar triangles *ace* and *adf*

$$\frac{ab}{bc} = \frac{bc}{be}, \text{ and } \frac{ab}{bd} = \frac{bd}{bf}$$

$$ab = \frac{(bc)^2}{be} = \frac{(bd)^2}{bf}$$

$$\frac{(bd)^2}{(bc)^2} \times be = bf$$

$$\frac{bd}{bc} = \sec \alpha = \frac{1}{\cos \alpha}$$

$$bf = \frac{be}{\cos^2 \alpha}$$

Since we are considering an infinitely small portion of the helix, let the side *ac* approach zero. As it becomes smaller *be* approaches *ae*, and *bf* approaches *af*. Hence,

$$af = \frac{ae}{\cos^2 \alpha}$$

We know that the normal circular pitch equals the circular pitch multiplied by cos α, and

$$\frac{N'}{N} = \frac{D'p}{Dp'}$$

in which D represents the pitch diam. and p the circular pitch.

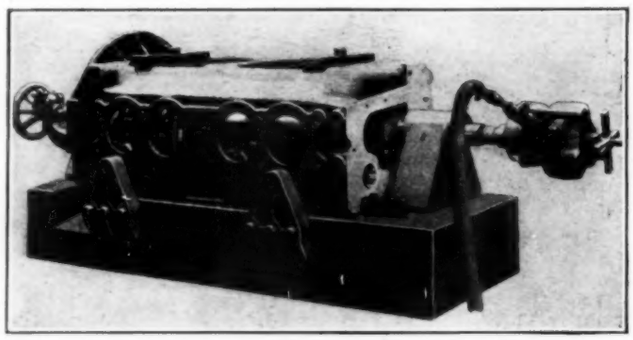
$$\text{Then } \frac{N'}{N} = \frac{1}{\cos \alpha} \frac{D'}{D} = \frac{1}{\cos \alpha} \frac{af}{ae} = \frac{1}{\cos^2 \alpha}$$

$$\text{and } N' = \frac{N}{\cos^3 \alpha}$$

Reaming Crankcases by Air Motor

By H. E. Crawford

The method employed by the C. L. Best Tractor Co., San Leandro, Cal., in the final reaming of crankcases, utilizes a Little David air drill as shown. The crank-



LINE REAMING WITH AN AIR MOTOR

cases are properly located on a substantial fixture which guides the line-reaming bar.

Cutters are provided for each bearing, so that the feed is limited by the length of the longest bearing. The feed is secured by the hand wheel at the left, which actuates the feed screw.

What About Automobile Shops?

BY A. L. DE LEEUW AND K. H. CONDIT
Consulting Editor, *American Machinist* Editor, *American Machinist*

Second article takes up drilling operations—Poor drill grinding an almost universal failing — Need for some test of drill grinding — Too little use of power feeds

IN OUR TRIP through the big automobile plants, the one thing that impressed us as a general fault in every plant was the inefficiency of drilling operations. In many shops the machine equipment was entirely adequate, in others it was not. But no matter what the condition of the equipment, it was seldom used to the maximum advantage because of poor drill grinding.

So much has been said about the necessity of proper grinding of twist drills that it seems almost like tiresome repetition to go through it again. The only reason we mention it is because of the general disregard of the first principles of proper drill grinding in almost every shop we visited. It is our guess that fully four-fifths of the drills we saw in operation were drilling with one lip only. When this condition exists, not only is the direction of the hole uncertain, but the hole will not be accurate as to size, being larger than the nominal diameter of the drill. In addition, the efficiency of the drill press is approximately cut in half when only one lip of a two-lip drill is cutting. The problem might be stated in this way: If one lip of a drill can stand a feed F, then the work itself can stand a feed 2F. If an attempt is made to force the drill with only one cutting lip to the output that should be obtained, the result of course is speedy breakdown of the drill.

The situation we have described indicates either one of two failings—the lack of proper equipment in good drill grinders, or else their improper use. So essential is this matter of proper drill grinding to satisfactory drilling machine production that we believe it desirable to work out some simple method of checking up the work of the drill grinders. Something like this might be worked out at small cost: Some sort of a device to hold the drill, so that it can be rotated by hand to take a chip from a piece of copper or other soft metal. Placed in this holder, the drill would be rotated by hand until one lip took a small chip from the copper. Upon further rotation without feed, the second lip should not take a chip. The drill would then be advanced slightly, so that the second lip would take a chip and the test repeated to see that the first lip did not take one. If neither lip takes a chip upon following the other one, it is evident that both lips are of the same length. The time of the test could be cut in half by providing two pieces of copper 180 deg. apart, so that one rotation of the drill would complete the test.

Both lips of the drill, of course, should have the same angle and adequate clearance, but these points ought to be taken care of automatically if a proper sharpener is used.

Where we had expected to find power feed in almost universal use where drill presses were in action, we found in some of the shops that lever feed presses predominated. One reason advanced for this situation was that a man working piece work with a lever feed machine gets out greater production than where power feed is supplied. It should be obvious that a drill will stand the same amount of feed under power drive as it will under hand drive. As a man does not apply uniform pressure and feed throughout the full travel of the drill, there is no reason why power feed should not give greater production, because the maximum feed applied by hand during a part of the travel can be applied uniformly by power throughout the whole travel.

With hand feed, entirely too much of the worker's energy is dissipated in the hard work of feeding the drill. The feeding should be left to mechanical means, so that the man can devote his whole effort to chucking the work and starting the machines. Depending on the relative time of chucking and drilling, a man could be given two, three, or perhaps four drill presses to operate, the fundamental principle being to keep both man and machines constantly occupied. The principle just enunciated is the one that underlies successful shop management in any line of work, and one that is very frequently violated, with bad results so far as economy of operation is concerned.

GENERAL disregard of the first principles of drill grinding points to the need of some means of testing a drill to determine whether it has been accurately ground.

Production is being seriously reduced by using poorly ground drills and by not driving power fed drills hard enough.

Fundamental principle of good management which requires that both man and machine be constantly occupied sometimes is violated with unfortunate results.

Requirements of deep hole boring indicate the need for a machine so designed that both work and tool rotate.

Track systems not always well designed. The same statement applies to loading fixtures and turntables.

Multiple spindle drills of high efficiency have been developed for the automobile industry, and we saw many of them in operation. Some of them were doing all they were designed to do, while others were not being used to full advantage. The relation of loading time to drilling time was too great, thus keeping expensive, high-production machines idle too much of the time. Much of this lost time could have been saved by a wider and better application of loading fixtures or turntables, as the circumstances dictated.

Arrangement of Drilling Spindles

In some of the shops we saw multiple spindle presses arranged for drilling and reaming or counterboring, but in others the various operations were separated, entailing additional and unnecessary handling and loading time. It should be stated here that we are not endeavoring to lay down a hard and fast rule to the effect that drilling, reaming and counterboring should always be done on the same machine with one set-up of the piece. In determining the economy of such an arrangement, several variable factors must be considered, among them the complexity of the piece and the holding fixture, the number of spindles, the time required for the longest operation, and so forth.

Failure to think things through to a conclusion was in evidence in some places. In one place, a drilling machine turntable was working at only half capacity because of the fact that it had but two instead of four stations and fixtures. In another place, the track system serving a group of multiple drills was so arranged that generally only one of the drills was working at a time. A circular track or some other convenient means of returning the fixture to the starting point would have overcome the difficulty here. The fault was not with the operators who were doing the best they could under the circumstances.

In one shop we encountered the complaint that the construction of the tools was not sufficiently rigid to withstand the heavy feed necessary for maximum output. Perhaps one reason for this complaint was the age and general condition of most of the drilling machines of various types in that particular shop. Some of them had evidently seen hard service.

We saw some excellent installations of machines for boring holes, more particularly for cylinder boring. The boring bars used were practically the same size as the circle swept by the boring tool, thus insuring straightness of the hole by making the finished work an extension of the jig eye and thereby improving the guidance of the tool. Some other boring installations were not nearly so satisfactory, the jig eyes being entirely too short to give the necessary support and guidance. This failing was also evident where reaming was the operation in question.

Apparently, it is not generally understood that the finish and accuracy of a reamed hole can be greatly improved if the jig eye is made from four to six times as long as the depth of the hole to be reamed. For short holes, this proportion can even be exceeded. Where long holes are to be reamed, improvement can be secured by pulling rather than pushing the reamer through. If there is any deviation in the axis of the drilled hole, the pushed reamer is quite likely to follow it, at times even increasing the inaccuracy. The pulled reamer, on the other hand, will have a tendency to straighten out the fault that may exist in the drilled hole.

For both drilling and boring of deep holes the best results are obtainable in machines with provision for rotation of both the work and the tool. Extreme cases, in fact, can only be handled satisfactorily in this way. Very few such machines are in evidence in the automobile plants.

The boring tools themselves were not always all that could be desired in design and condition. Some of them had entirely too many blades. There is no advantage in an excessive number of blades, and there is a disadvantage if the dulling of a single one spoils the hole and requires the sharpening of the entire tool.

What was said before about keeping drilling machines occupied as much of the time as possible applies with equal force to boring machines. In some of those observed, output was reduced because of insufficient number of stations or fixtures on the turntables.

To finish up the subject of holes, we might mention two instances of bad broaching practice that came to our attention. In one case, where a rather heavy sectional broach was in use, no provision had been made for quick removal of the key connecting two of the sections. As a result, two men lost considerable time, in addition to their tempers, endeavoring to remove the key from a rather battered slot.

The other instance had to do with a double broaching machine attended by one man, where the motion was so slow that he had to spend more than half of his time waiting for the head to return before inserting a new piece. In this case, the operation might have been performed in considerably less time and at less expense with a greater number of short push broaches. It was just one more instance of the failure to observe the principle already enunciated of keeping both operator and machine constantly busy.

Trouble with Countershaft Clutches—Discussion

By S. H. Simon
The Carlyle Johnson Co.

Regarding the question raised by H. Maplethorpe on the above subject in his article on page 413, Vol. 59, of the *American Machinist*, the answer is simple.

Have each case diagnosed, as regards all conditions of actual use, as a physician would diagnose a case. Then put the data in the hands of a reliable clutch manufacturer whose engineers have had sufficient experience to recommend the best for the place, after they know all the conditions.

No stock clutch of any make is successful on all kinds of drives. The Johnson friction clutch can be modified to meet almost any condition for light powered drives if the firm's engineers are given a chance, and this may be true of other makes of clutches.

Most machinery manufacturers pay too little attention to the design of their countershaft clutches, after putting the effort they do into the design of their machines, and the main reason that their clutches are not serviceable is that they have not had extended experience in manufacturing clutches.

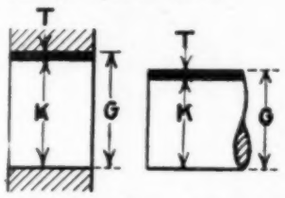
Nine-tenths of all clutch trouble is due to lack of or faulty lubrication and the other tenth to inattention to the adjustment of the clutch when it should be adjusted. Having manufactured clutches for nineteen years, from the job of office boy to general manager, I submit the above as the answer.

German Standards for Tolerances and Allowances in Machine Fits

By OSCAR R. WIKANDER

DIN | Tolerances and Allowances in **Machine Fits** Fundamental Terms and Definitions | DINORM **775** Sheet 1

In the manufacture of any object it is impossible to obtain exactly a certain desired size (Example: 59.95) and, therefore, two limits have to be prescribed, one maximum size *G* ("Grosstmass"), (Example: 59.97) and a minimum size *K* ("Kleinstmass"), (Example: 59.94). (See sketch).

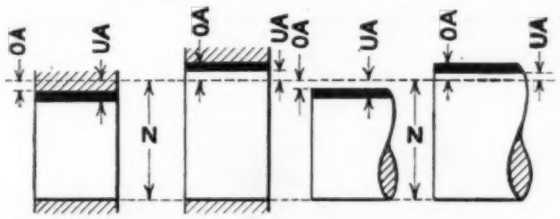


G = Maximum Size ("Grosstmass")
K = Minimum Size ("Kleinstmass")
$T = G - K$ = Tolerance

Maximum Size ("Grosstmass")
Minimum Size ("Kleinstmass")

Maximum size *G* and minimum size *K* are the two limiting dimensions between which the size of a certain part must be kept.

Tolerance—The tolerance *T*, is the difference between the maximim and minimum sizes, $T = G - K$, (Example: $T = 59.97 - 59.94 = 0.03$).



Basic Size—The two limiting dimensions are variations from a certain exact theoretical value, the basic size *N* ("Nennmass"), (say 60).

Upper Variation ("Oberes Abmass") The upper variation *OA*, is the difference between the maximum and the basic size, *G*—*N* (Example: 59.97 — 60 = —0.03).

Lower Variation ("Unteres Abmass") The Lower Variation *UA* is the difference between the minimum and the Basic Size K—N (Example: 59.94 — 60 = —0.06).

The limiting dimensions are generally indicated by the upper and lower variations, the former written above, the latter behind the basic size (Example: $60\ ^{-0.03}_{-0.06}$). In case of standard fits, a symbol is substituted for the two variations. (Example: 60 ϕL). Corresponding external and internal members have the same basic size.

Actual Size ("Istmass")—The actual size of a part is the actually measured size of that part. The actual size of any machine part must lie within the tolerance limits of same.

Variation ("Abmass")—The variation of a machine part is the difference between its actual and basic sizes (Example: If measured 59.95, variation = 59.95 — 60 = —0.05).

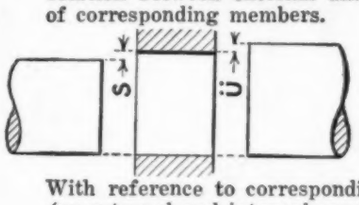
October 14, 1922. (Continued on Sheet 2)

Copyright by Normenausschuss der Deutschen Industrie

THE GERMAN Standards Committee has just about completed its fundamental work on tolerances and allowances in machine fits, and the important results of about five years' painstaking investigation will soon be published in book form, in the form of a so-called DINBUCH.

DIN | Tolerances and Allowances in **Machine Fits** Fundamental Terms and Definitions | DINORM **775** Sheet 2

The Fit ("Passung") is the general designation of the relation between external and internal dimensions of corresponding members.

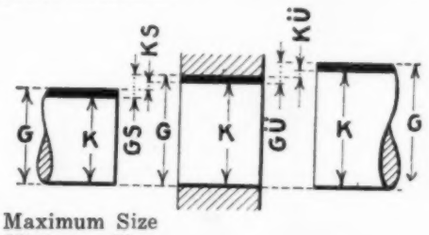


S = Looseness ("Spiel")
$\ddot{U}$ = Tightness (Übermass)

With reference to corresponding bores and shafts (or external and internal members in general), we distinguish between:

The Looseness ("Spiel") *S*, which is the difference between the diameters of the bore and the shaft, when the former is the larger one, and

The Tightness ("Übermass") $\ddot{U}$, which is the difference between the diameters of the bore and the shaft, when the latter is the larger one. Tightness is negative Looseness.



G = Maximum Size
K = Minimum Size
GS = Maximum Looseness ("Grösstspiel")
KS = Minimum Looseness ("Kleinstspiel")
$G\ddot{U}$ = Maximum Tightness ("Grösstübermass")
$K\ddot{U}$ = Minimum Tightness ("Kleinstübermass")

Maximum Looseness (or Allowance plus Tolerances) *GS*, is the difference between the maximum size of the bore (Example: 60.03) and the minimum size of the shaft (Example: 59.94). ($GS = 60.03 - 59.94 = 0.09$).

Minimum Looseness (or Allowance) *KS*, is the difference between the minimum size of the bore (Example: 60.00) and the maximum size of the shaft (Example: 59.97). ($KS = 60.00 - 59.97 = 0.03$).

Maximum Tightness (or Negative Allowance) $G\ddot{U}$, is the difference between the maximum size of the shaft (Example: 45.06) and the mimimum size of the bore (Example: 45.00). ($G\ddot{U} = 45.06 - 45.00 = 0.06$). (Negative Minimum Looseness.)

Minimum Tightness (or Negative Allowance plus Tolerances) $K\ddot{U}$, is the difference between the minimum size of the shaft (Example: 45.040) and the maximum size of the bore (Example: 45.025). ($K\ddot{U} = 45.040 - 45.025 = 0.015$.) (Negative Maximum Tightness.)

(Continued on Sheet 3)

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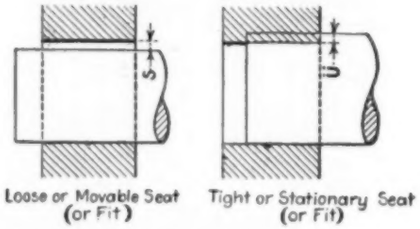
DIN | Tolerances and Allowances in **Machine Fits** Fundamental Terms and Definitions | DINORM **775** Sheet 3

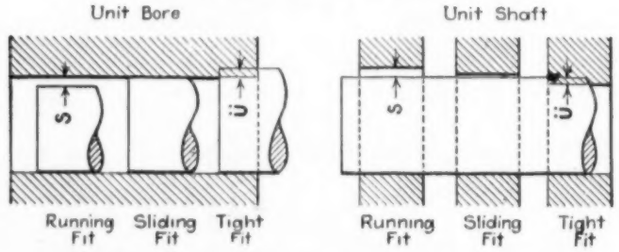


Loose or Movable Seat (or Fit).
("Bewegungssitz" or "Laufsitz").
Tight or Stationary Seat (or Fit).
("Ruhesitz" or "Festsitz").

Seat (or Fit). When an external member is mounted on a shaft a certain Seat (or Fit) is obtained.

A Loose or Movable Seat is obtained when there is sufficient alowance to permit the two members to move in service in relation to each other. A Tight or Stationary Seat is obtained when the allowance is smaller or negative.

System of Seats (or Fits)—A series of various seats or fits, determined according to certain principles, is called a System of Seats (or Fits).



The German Standards (or "Dinorms") contain two different systems of Seats (or Fits):

The Unit Bore System, see Dinorm 777.

The Unit Shaft System, see Dinorm 778.

In the Unit Bore System all the seats have the same size bore. The shafts are made to the necessary size so as to obtain the required seat or fit.

In the Unit Shaft System all the seats have the same size shaft. The bores are made to the necessary size so as to obtain the required seat or fit.

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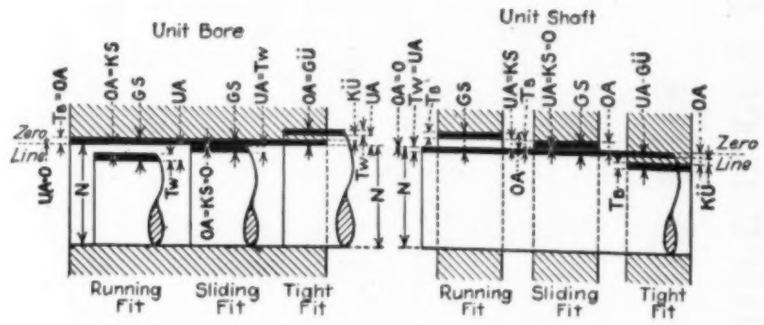

In the **Unit Bore System** the basic size is the minimum size of the bore. The upper variation of the bore is thus equal to the bore tolerance (T_B), the lower variation is zero. For the shafts, the upper variation is equal to the minimum looseness (or maximum tightness). The lower variation is larger, their difference being equal to the shaft tolerance (T_W). (In case of tightness the lower variation is smaller than the upper one.)

In the **Unit Shaft System** the basic size is the maximum size of the shaft. The upper variation is consequently zero and the lower one equal to the shaft tolerance (T_W). For the bores the lower variation is equal to the minimum looseness (or maximum tightness). The upper variation is larger, their difference being equal to the bore tolerance (T_B). (In case of tightness the upper variation is smaller than the lower one). The basic size is thus, in either system, the basis for the distribution of the tolerances and allowances.

The Zero Line limits, in the Unit Bore System, the minimum size of the bore and the latter is equal to the basic size. In the Unit Shaft System the Zero Line limits the maximum size of the shaft and the latter is equal to the basic size. The tolerances and allowances are counted positive or negative, depending upon their location in relation to the zero line. The "Gleitsitz" shaft in the unit bore system is the same as the unit shaft and the "Gleitsitz" bore in the unit shaft system is equal to the unit bore.

(Continued on Sheet 4)

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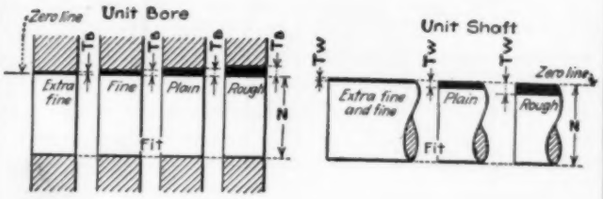
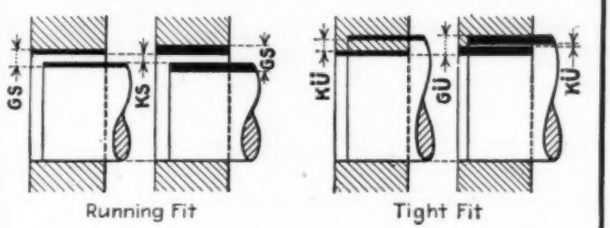
DIN | Tolerances and Allowances in **Machine Fits** Fundamental Terms and Definitions | DINORM **775** Sheet 4



Grade of Fit ("Gutegrad")—According to the requirements as to the grade or quality of work, the tolerances are made narrower or wider, and, in addition to the different classes of fits, we have different grades of fits for each class. Arranged according to increasing tolerances, we distinguish the following four grades of fits:
Extra fine, Fine, Plain and Rough.
(Edelpassung, Feinpassung, Schlichspassung, Grobpassung).
The location of the zero line is the same for the different grades of fits.



Running Fit Tight Fit

Seats of the same class have always the same minimum looseness (or allowance) *KS*, and, respectively, the same maximum tightness (or negative allowance) *GÜ*. The maximum looseness (or allowance plus tolerances) *GS*, and respectively, the minimum tightness (or negative allowance plus tolerances) are, however, different on account of the varying tolerances.
In changing from one grade of fits to another, the interchangeability of parts is retained for fits of the same class, provided the conditions of operation permit of the changes of the maximum looseness, *GS*, respectively the minimum tightness, *KÜ*.

Fit Tolerance ("Passungstolerance") *P*, is the sum of the tolerances of a bore and of the corresponding shaft. $P = T_B + T_W$ and consequently is equal to the difference between the maximum and minimum looseness, and, respectively, between the minimum and maximum tightness. $P = GS - KS = KÜ - GÜ$.
The character of a certain class of fit is only retained in its average looseness or tightness and is more or less lost in the extreme cases.
The closer tolerances of the finer grades reduce the Fit tolerance and consequently offer a greater guarantee for the conservation of the character of a certain desired fit.

Tolerance Unit—The looseness (or tightness) for a certain class of fits is a function of the diameter *D*. It is assumed to be proportional to $\sqrt[3]{D}$.
The Tolerance (or Fit) Unit *PE*, is computed from the formula:

$$1PE = 0.005 \sqrt{D} \sqrt[3]{D}$$

where *D* is the diameter in millimeters.

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DIN | Tolerances and Allowances in **Machine Fits** Symbols of Grades and Classes of Fits | DINORM **776**

Grade of Fits ("Gutegrad")			Unit Bore ("Einheitsbohrung")		Class of Fit ("Sitze")	Unit Shaft ("Einheitswelle")	
Name	Symbol	Color of Gage	Bore	Shaft		Bore	Shaft
Extra Fine Grade ("Edelpassung")	e	The Blue of the Cornflower	eB	F	Tight Seats ("Ruhesitze") Edelfestsitz	eF	W
				T	Edeltreibsitz	eT	
				H	Edelhaftsitz	eH	
				S	Edelschiebesitz	eS	
					Loose Seats ("Bewegungssitze")		
				G	Edel-Gleitsitz	eG	
Fine Grade ("Feinpassung")		Black	B	F	Tight Seats ("Pressitz")* Festsitz	F	W
				T	Treibsitz	T	
				H	Haftsitz	H	
				S	Schiebesitz	S	
					Loose Seats		
				G	Gleitsitz	G	
				EL	Enger Laufsitz	EL	
				L	Laufsitz	L	
				LL	Leichter Laufsitz	LL	
				WL	Weiter Laufsitz	WL	
Plain Grade ("Schlichtpassung")	s	Yellow	sB	sG	Loose Seats: Schlicht-Gleitsitz	sG	sW
				SL	Schlicht-Laufsitz	sL	
				sWL	Weiter Schlicht-Laufsitz	sWL	
Rough Grade ("Grobpassung")	g	Light green	gB	g1	Loose Seats: Grobsitz g1	g1	gW
				g3	Grobsitz g3	g3	
				g4	Grobsitz g4	g4	

The purposes of the symbols are:
Dinorm 249) to indicate the gages on the drawings to serve as distinguishing marks on the gages (see (see Dinorm 406, Sheet 5). The plug gages in the system Unit Bore correspond to those of "Gleitsitz" and "Grobsitz *g*1" in the system Unit Shaft as follows:
$eB = eG$; $B = G$; $sB = sG$, and $gB = g1$
The snap gages in the system Unit Shaft correspond to those of "Gleitsitz" and "Grobsitz *g*1" in the system Unit Bore as follows:
$W = G$; $sW = sG$, and $gW = g1$
*No symbols have as yet been agreed upon for "Pressitz," see Dinorms 54 and 55.

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Due to the fact that this subject is of great interest to the mechanical engineers of this country, the writer has obtained the permission of the German Standards Committee to publish some advance information on the subject, as well as translations of the most important German Standard Sheets, or DINORMS, which refer to said subject.

The fundamental technical terms and their definitions are recorded and explained in DINORM 775, Sheets 1 to 4 inclusive.

The symbols of the various grades and classes of fits are given in DINORM 776.

DINORM 777, illustrates the variations for the various grades and classes of fits in the unit bore system, while DINORM 778 shows a corresponding diagram for the unit shaft system.

DIN | Tolerances and Allowances for **Machine Fits** Diagram of the Unit Bore System | DINORM **777**

Grade of fit		Extra Fine					Fine[1]								Plain			Rough		
Symbol	Bore	eB					B								sB			gB		
	Bore Gage	eB = eG					B = G								sB = sG			gB = gI		
Dinorm		18					19								148			159		
Class of Fit		Edelfestsitz	Edeltreibsitz	Edelhaftsitz	Edelschiebesitz	Edelgleitsitz	Festsitz	Treibsitz	Haftsitz	Schiebesitz	Gleitsitz	Enger Laufsitz	Laufsitz	Leichter Laufsitz	Weiter Laufsitz	Schlichtgleitsitz	Schlichtlaufsitz	Weiter Schlicht-laufsitz	Grobsitz g1	Grobsitz g3	Grobsitz g4
Symbol	Shaft	F	eT	H	S	G	F	T	H	S	G	EL	L	LL	WL	sG	sL	sWL	g1	g3	g4
	Shaft Gage	F	eT	H	S	WG	F	T	H	S	W-G	EL	L	LL	WL	sW=G	sL	sWL	gW=g1	g3	g4
Dinorm		26	58	25	24	23	26	58	25	24	23	22	21	20	52	151	150	149	163	161	160

Tolerance Units 1 PE = 0.005 ∜D (D in millimeters)

Zero

Tolerance Range of { The Bore / The Shaft

[1] The press fit, Dinorm 54, is not represented in this diagram

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DIN | Tolerances and Allowances for **Machine Fits** Diagram of the Unit Shaft System | DINORM **778**

Grade of Fit		Extra Fine					Fine[1]								Plain			Rough		
Class of Fit		Edelfestsitz	Edeltreibsitz	Edelhaftsitz	Edelschiebesitz	Edelgleitsitz	Festsitz	Treibsitz	Haftsitz	Schiebesitz	Gleitsitz	Enger Laufsitz	Laufsitz	Leichter Laufsitz	Weiter Laufsitz	Schlichtgleitsitz	Schlichtlaufsitz	Weiter Schlicht-laufsitz	Grobsitz g1	Grobsitz g3	Grobsitz g4
Symbol	Bore	eF	eT	eH	eS	eG	F	T	H	S	G	EL	L	LL	WL	sG	sL	sWL	g1	g3	g4
	Bore Gage	eF	eT	eH	eS	eB=G	F	T	H	S	B-G	EL	L	LL	WL	sB=G	sL	sWL	gB=g1	g3	g4
Dinorm		51	56	50	49	48	47	57	46	45	44	43	42	41	53	157	156	155	169	166	165
Symbol	Shaft	W														sW			gW		
	Shaft Gage	W=G														sW=sG			gW=g1		
Dinorm		40														154			164		

Tolerance Units 1 PE = 0.005 ∜D (D in Millimeters)

Zero Line

Tolerance Range of { The Bore / The Shaft

[1] The Press Fit, Dinorm 55, is not Represented in this Diagram

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In addition to the grades of fits, recorded in the above DINORMS, an extra rough grade has recently been adopted and the corresponding variations are given in DINORM 170.

The latest additions to the DINORMS on tolerances are those for press fits, which are covered by the following two standard sheets:

Pressitz, fine grade of fit, unit bore system, DINORM 54
Pressitz, " " " " " " " DINORM 55

The tolerances for the adjustment of working gages are laid down in *Dinorm 168.*

DINORM 406, Sheet 5, shows how tolerances and fits are indicated on standardized German drawings.

Separate DINORMS are published for each class of fits, in each grade of fits, in the unit bore as well as in the unit shaft system and the exact dimensions of new gages, the corresponding calculated looseness or tightness, as well as the type of gage to be used and the maximum permissible wear of same, are given for all diameters from 1 to 500 mm. The numbers of these separate DINORMS are given under each class of fits on DINORMS 777 and 778. We reproduce two specimens of same, DINORMS 22 and 46, in translation.

The proper variations for shrink fits depend on so many factors and the opinions of the experts differ to such an extent, that it has not as yet been found possible to arrive at any generally applicable standards.

The Germans have standardized on *two* complete systems of fits and tolerances, the unit bore and the unit shaft systems for the reason that in some cases one of these systems, in other cases another, brings such great economical advantages, that none of the several combined systems which have been proposed, has been found acceptable as a substitute for both.

It will further be noted that the basic size always forms the lower limit of the tolerance field in the unit bore, and the upper limit of said field in the unit shaft system. The advantages of this feature, in comparison to the practice on some of the older systems to arrange the tolerance field symmetrically on both sides of the basic size, are many. The most important one is, perhaps, that parts made according to different grades of fits are interchangeable, as long as they are made for the same class of fits.

In order to express the variations and tolerances in the same number of tolerance units (*PE*), for all shaft and bore diameters, the value of said unit must increase with the diameters. The value of 1*PE* can be computed from the formula, given in DINORM 775, Sheet 4, where *PE* as well as *D* are expressed in millimeters.

The entire range from 1 to 500 mm. has been divided in a number of sections and within each section the variations for the two extreme diameters have been calculated. Their arithmetic mean has then been accepted as the constant standard variation for the corresponding section.

ALL DINORMS, the above DINBUCH and all other publications of foreign standard committees, respectively, will be for sale at the offices of the American Engineering Standard Committee, 29 West 39th Street, New York City.

(To be continued in an early issue)

Test Shows No Abrasive in Bronze Bushings

In the May-June, 1921, issue of *Grits and Grinds* there appeared an article which gave the results of an attempt by the Norton Company's Research Laboratories to find abrasive particles imbedded in ground cast-iron cylinders. The conclusion drawn from this test was that at least as far as the sample submitted was concerned, there was no abrasive imbedded in the surface of the metal.

Recently, this question was reopened. This time instead of the subject being cast-iron cylinders, it was bronze bushings. Now, bronze offers but little resistance to penetration and still has the property of being fairly tough. If there is any possibility of a surface being impregnated with abrasive particles as a result of the grinding operation, it would seem that this metal would be more likely to be affected than almost any other.

In order to settle this question, another interesting experiment was carried out by the laboratories. Three bronze bushings were ground internally by Crystolon vitrified wheels, varying in degrees of hardness and fineness, all within the range of grains and grades commonly used for this work. The bushings were then split by means of a hacksaw. One-half of each bushing was examined chemically, the metal being dissolved for the purpose of learning if any residue remained and if this residue contained silicon carbide. The other half was examined under powerful binoculars for the presence of silicon carbide grain. Then the surface was scraped and the chips examined microscopically.

The results are interesting and conclusive. In no case by either method was it possible to detect the presence of abrasive. The same conclusion as was arrived at in a similar experiment with cast iron may be drawn, namely that no abrasive is imbedded in the metallic surface as a result of the grinding operation. *Grits and Grinds*, September, 1923.

Wanted—A Museum of Machine Tools—Discussion

By Harry E. Harris
Harris Engineering Co., Bridgeport, Conn.

On page 452 of the *American Machinist* there is an article by Mr. Thwing under the title "Wanted—A Museum of Machine Tools." It is proposed in this article to make a selection of exceptionally old machine tools and house them in some building as a museum.

I cannot conceive what value such a collection or museum would have, except to please a collector's whim or satisfy the idle curiosity of a few. Surely there would be nothing that would warrant the great expense that would have to be made in assembling such a museum and keeping it up.

It would seem to me that photographs and descriptions of such machine tools bound in book form would have whatever doubtful educational value such a museum might have, besides having the advantage of the possibility of wide distribution.

There are a large number of museums dotted all over the country at the present time whose only claim to value is their historical aspect; the interest in them is comparatively small, and without endowments they would not be kept up.

It would seem that a museum consisting of the very latest types of improved machine tools would be of considerably greater value and would have this advantage—it would receive the support of progressive engineers, manufacturers and technical schools.

A Troublesome Drive and Its Remedy

By John Williams

I DO NOT know whether or not the change indicated by the accompanying illustrations is properly to be included under the heading of "it pays to replace," but there can be no possible doubt of the benefit accruing from it; both in the matter of reduced cost of upkeep

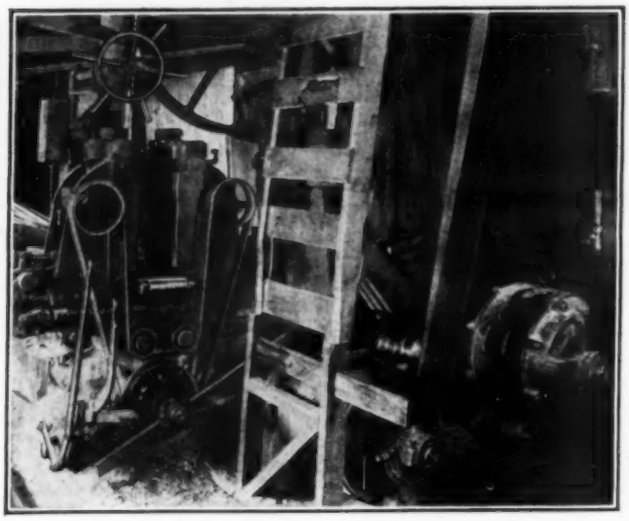


FIG. 1—BELT DRIVE TO A BAND RESAW

and in relief from continuous annoyance and exasperation. The saving of a great deal of hitherto wasted time and effort as well as a substantial reduction in power bills are also among the assets.

The machine involved is a heavy band resawing machine used in a lumber mill; the change being in the

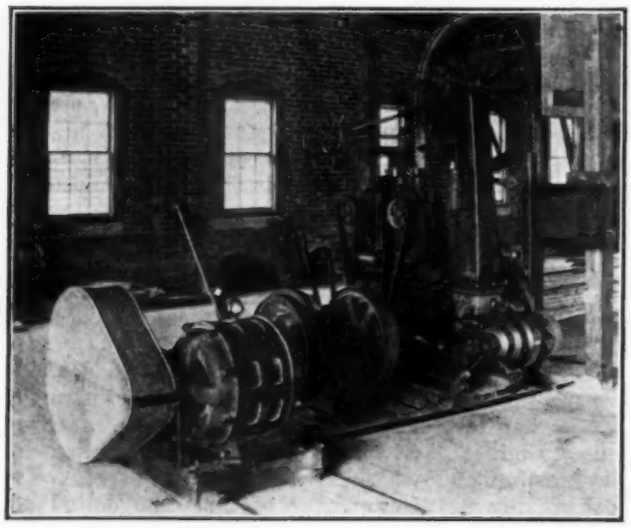


FIG. 2—BELTS REPLACED BY BRIDGEPORT REDUCTION GEARING

method of driving it and not in the machine itself, which remained the same in every particular after the new drive was installed.

The power was (and still is) derived from a 25-hp. Westinghouse induction motor which before the change was belted to an overhead countershaft from which a shifting belt drove to a pair of tight and loose pulleys on the first shaft of the machine. The motor belt was of canvas, 4 in. wide, and the shifting belt was of leather of the same width.

Now the climate of a lumber mill located in central New England is not exactly balmy during the month of January, and as much as fifteen minutes of time was often consumed in getting the saw up to speed on cold mornings. The shifting belt would slip and shriek, and the tight pulley would get so hot from the friction as to burn the leather. The canvas motor belt had been replaced as many as three times in one year and the leather belt was continually in need of attention. On one occasion a new kind of belt was put on by an enthusiastic belt salesman, who thought to eliminate all the trouble. This belt withstood the punishment for just three hours.

High Starting Loads Cause Trouble

In addition to all these troubles the starting load upon the motor was so high that fuses were frequently blown in the line, and the same thing happened from time to time as the saw struck a knot, or, perhaps, a spike.

Fig. 2 shows the same machine and motor, now driving to the first shaft of the machine through a regulation Bridgeport reduction gear train, a Dodge friction clutch and a special step-up train which is, in effect, the regular Bridgeport gear reversed.

The speed of the motor is 860 r.p.m. and the speed of the shaft the same. The logical thing to do, then, would seem to be to connect the motor shaft directly to the end of the saw shaft, but this was not considered practical because of the extremely high starting load that would be imposed upon the motor, and further because of the wide fluctuations in power demand resulting from the aforesaid knots and spikes. Neither was a high speed friction clutch in direct line desirable, and for much the same reasons.

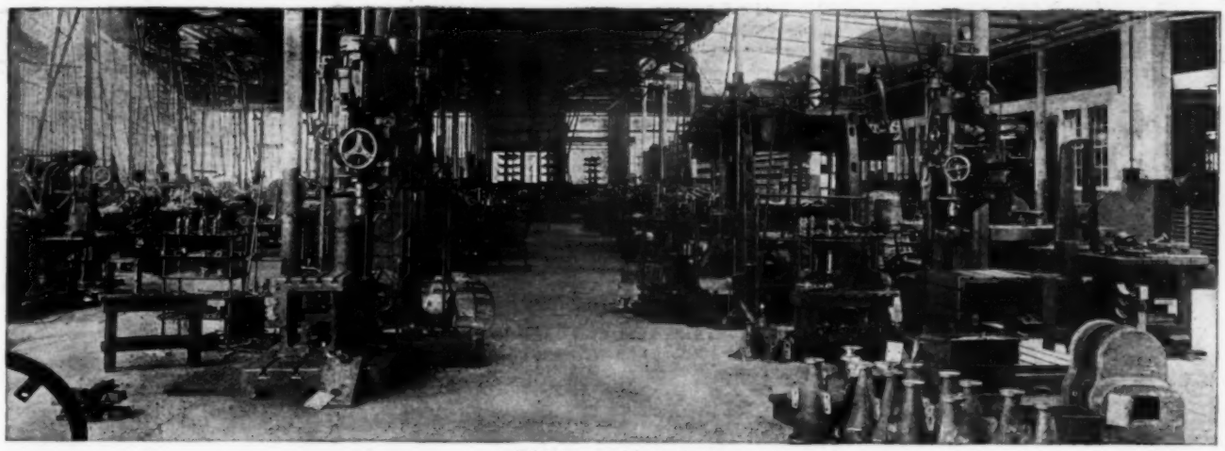
As arranged in Fig. 2 the motor drives the Dodge clutch through a 4 to 1 reduction gear consisting of a cast iron spur gear and a micarta pinion. The clutch drives the saw shaft through a practically identical train placed in reverse position. The clutch, running at a comparatively low speed, is kept in adjustment to carry the full load with a small allowance for overload. In starting up the machine in the morning the motor is first put in motion with the clutch out, and the lever of the latter is then eased over until the load is picked up and the machine in full operation. Any subsequent overload causes the clutch to slip and thus safeguard the motor.

Lapping Cylinders and Pistons

By Chas. F. Henry

The lapping of cylinders and pistons is not common practice and is usually resorted only to by builders of high-priced cars or those who are fitting up motors for special purposes, such as racing. In one such case the cylinder is enlarged from 0.010 to 0.015 in. by lapping, using No. 60 carborundum for roughing and No. 180 for finishing. The two lapping operations require about 15 minutes.

Pistons also are fitted by lapping with ground glass and oil. They are lapped from 0.0025 to 0.003 in. smaller than the cylinder bore to give the proper allowance for expansion.

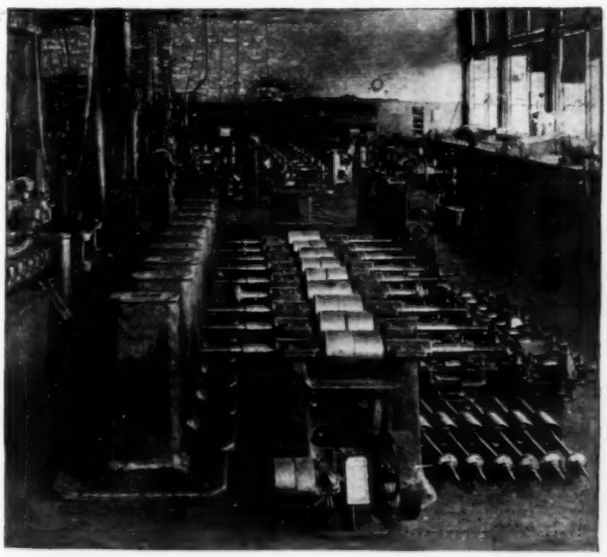


Light machine shop

Where Machine Tools Are Made

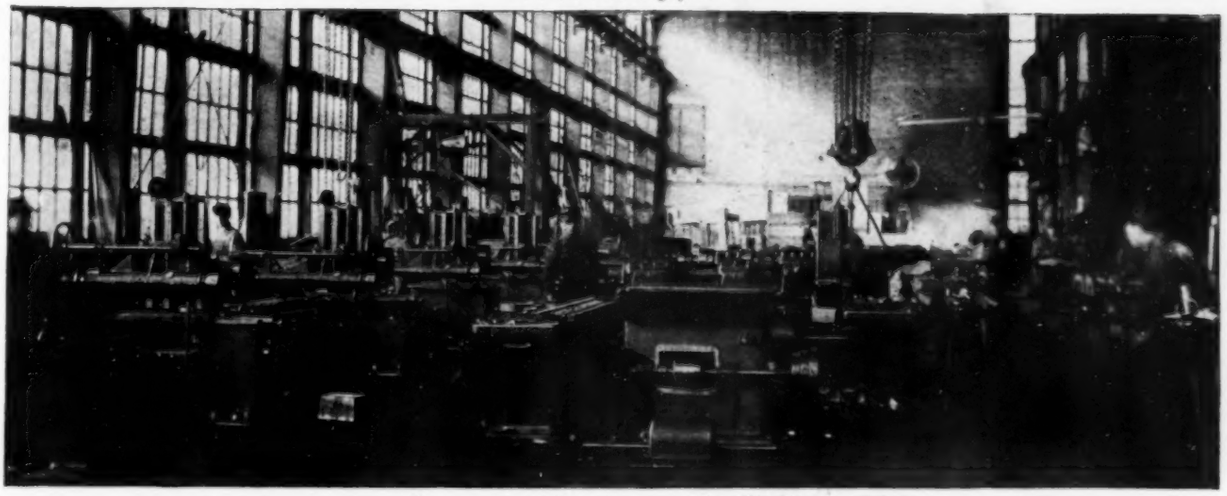
Diamond Machine Company

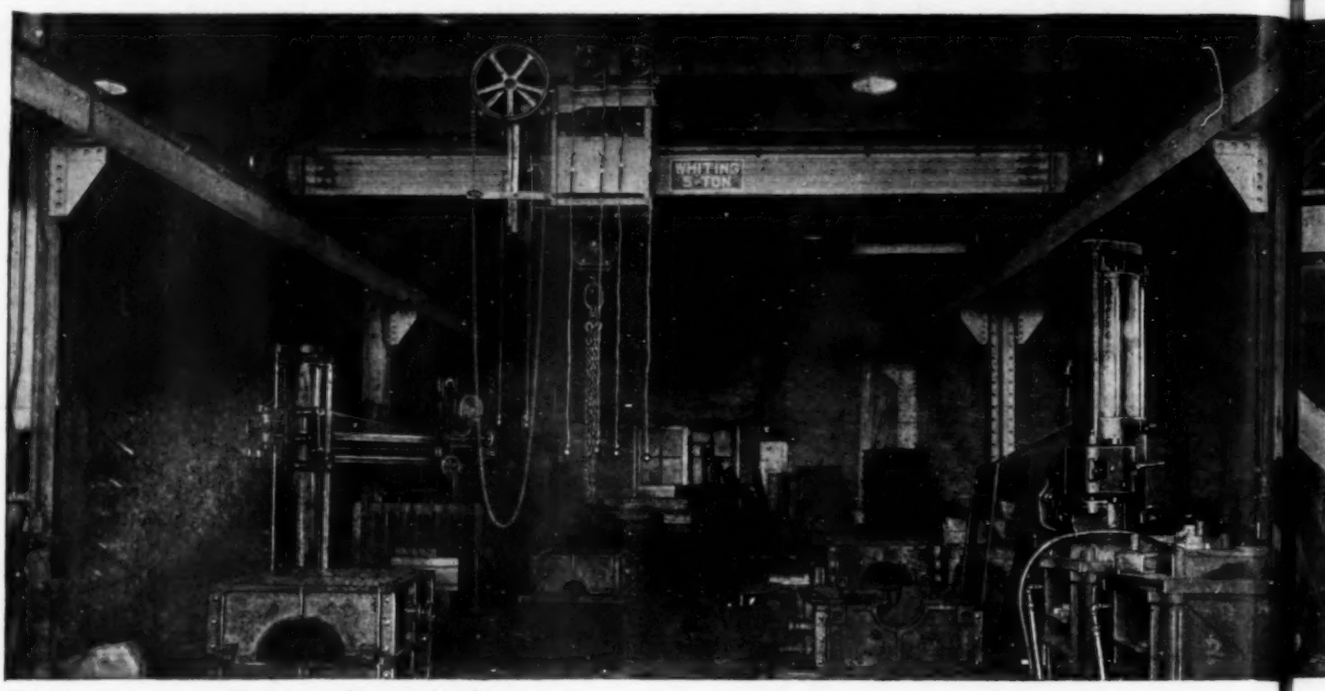
Assembly floor for lighter machines



A corner of the foundry

Main erecting floor



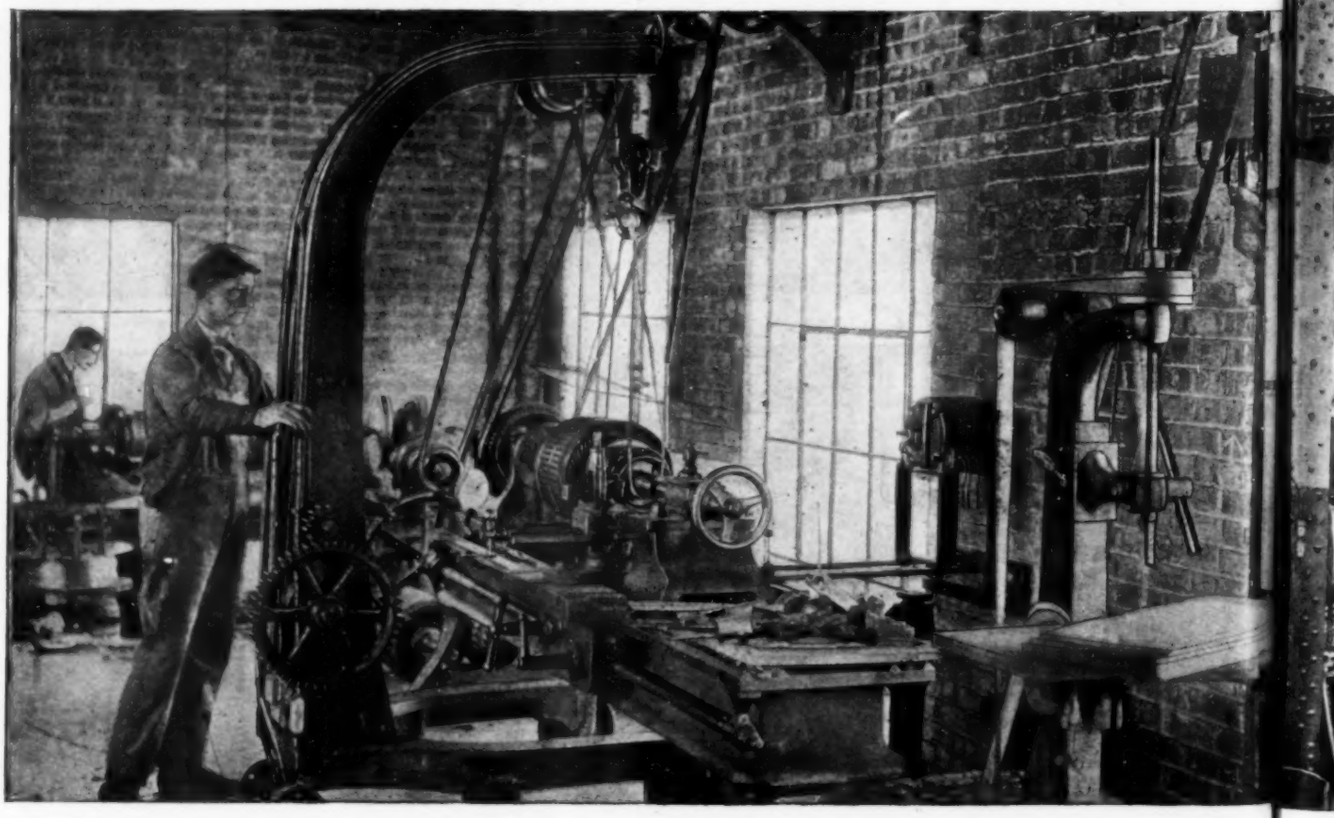


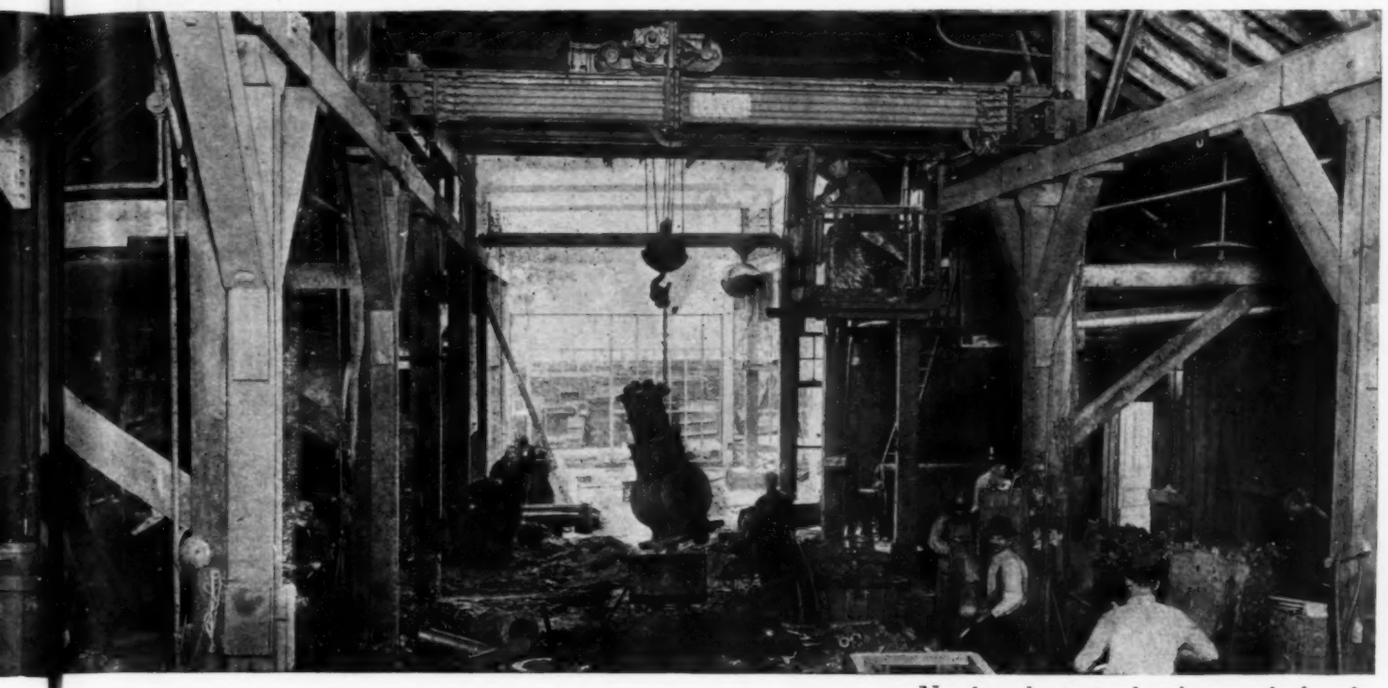
Whiting crane controlled from floor in side bay

IMMIGRATION—C

The Mechanical, Air or Electric H

Canton portable crane in electric railway repair shop

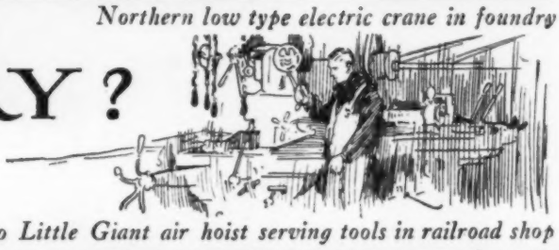




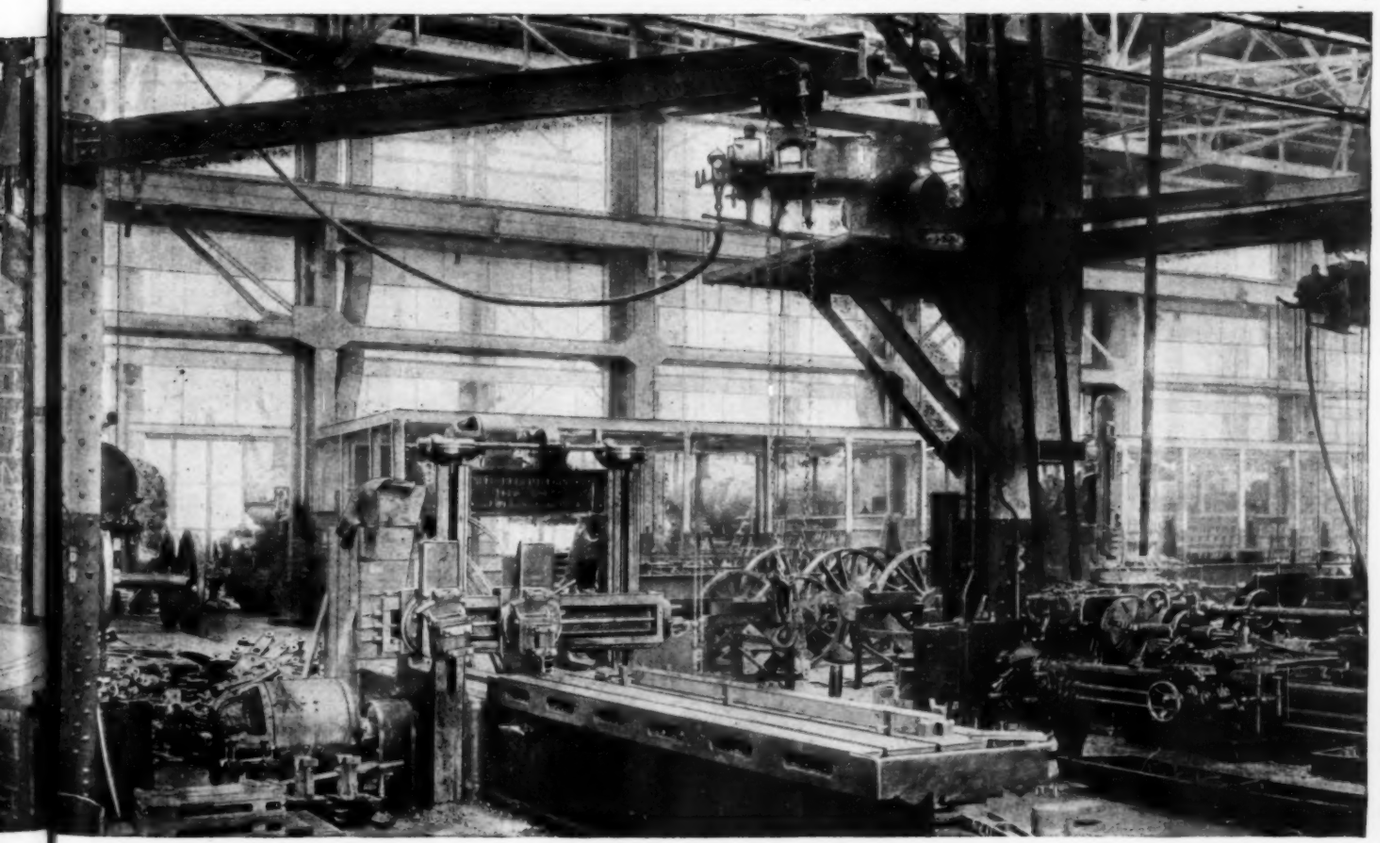
Northern low type electric crane in foundry

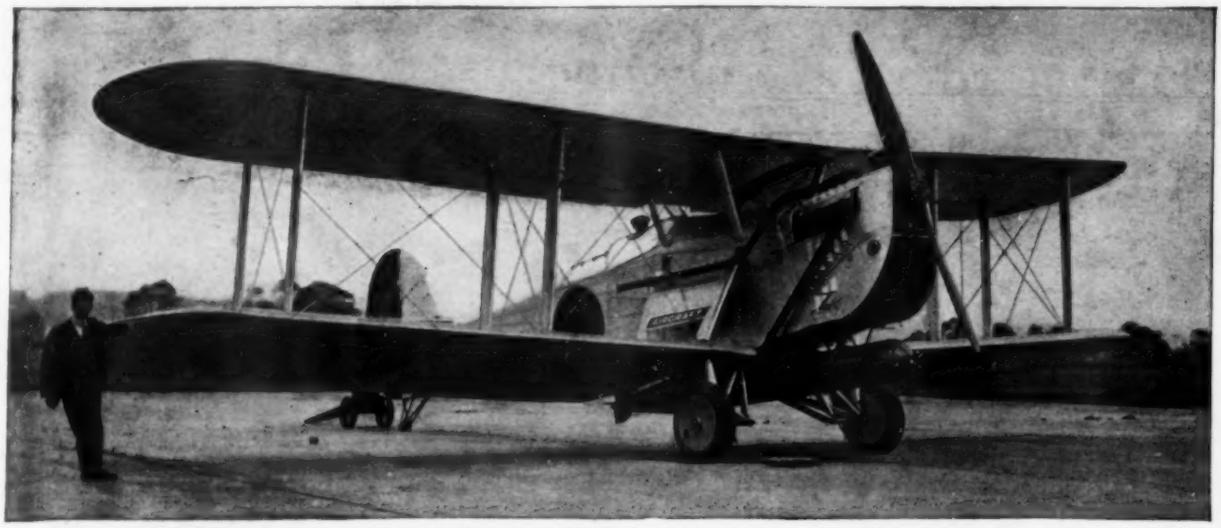
OR MACHINERY?

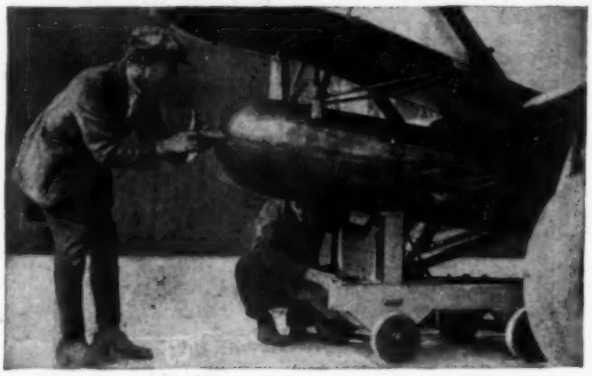
Hoist Offers Another Answer



Chicago Little Giant air hoist serving tools in railroad shop







Aerial Transport

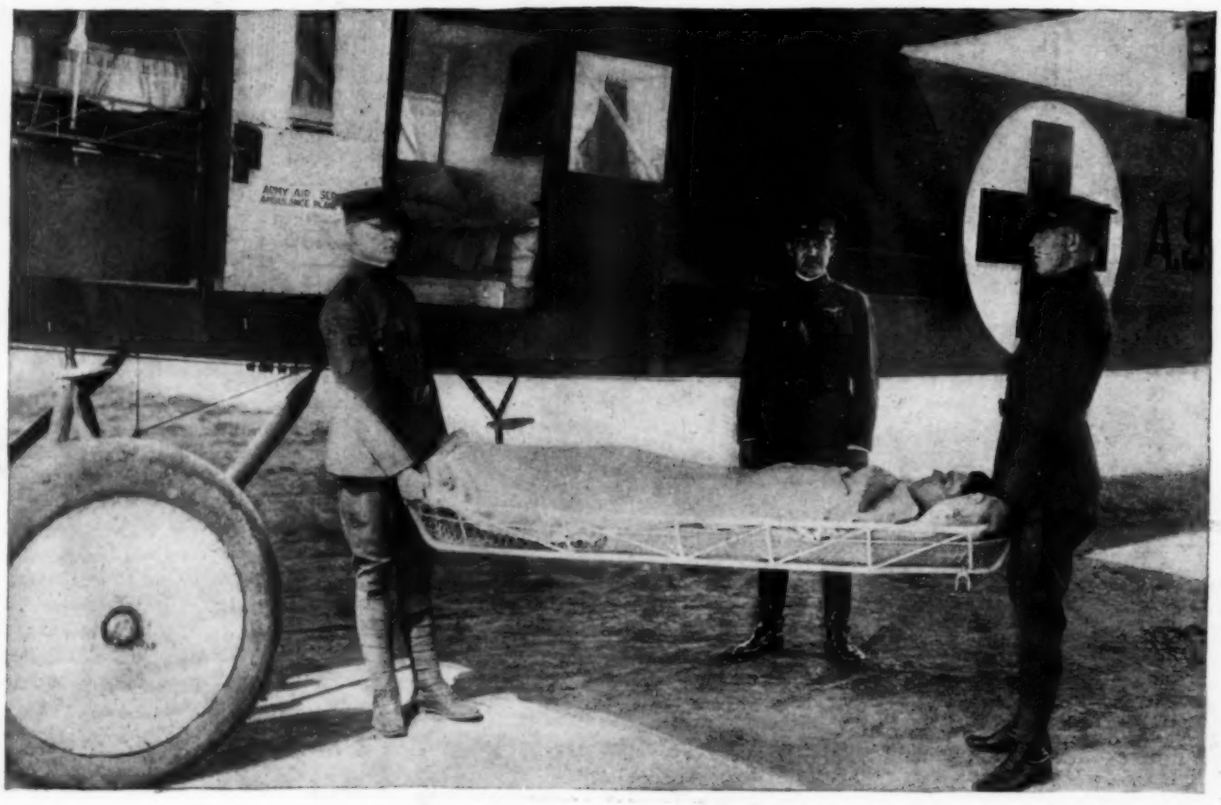
Destructive and Constructive

Above—New British Torpedo Plane.

Left—Mounting the Torpedo.

Below—Latest Ambulance Plane of U. S. Army Air Service has accommodations for pilot, doctor and four patients, two recumbent.

Photos by Kadel & Herbert, New York



Case Hardening and Other Heat Treatments As Applied to Gray Cast Iron

By H. B. KNOWLTON
Instructor in Metallography and Heat Treatment
Milwaukee Vocational School

Experiments conducted in heat-treating gray cast iron—Results indicate that gray cast iron can be made much tougher in the center and at the same time given a hard surface

SOMETIME ago the writer was informed that gray cast iron had been case hardened with commercial success. It was said that a certain firm had measurably increased the strength and wearing qualities of certain gray iron castings, by applying the treatments commonly used in case hardening steel. After this process, the castings were said to be fairly machineable in spite of their increased resistance to wear. The method was considered a success as long as it was applied to castings made by one foundry, but it failed on castings made in another foundry. Evidently the composition of the iron had a great deal to do with the success or failure of the method. The composition, however, of neither was known definitely. Both were simply classified as "gray iron."

The writer does not know how much has been done along this line, but so far has found nothing published on the subject. Consequently the research described in this paper was started. No claim is made that the paper is a complete exhaustive treatise on the subject. It merely attempts to give the status of the writer's research up to the present time. Criticisms, comment and suggestions are invited.

How Increase the Carbon Content?

Upon casual consideration, case hardening of gray cast iron did not seem feasible to the writer, and yet it was claimed that good results had been so produced. A gray cast iron obviously contains more carbon than can be retained in the combined condition. How then, could heating in a carburizing material increase the carbon content of the surface? The writer's only experience with cast iron heated in contact with a carburizing material, consisted in the use of cast iron pots and boxes used as containers in the carburizing process. It is a well known experience that such boxes "grow" on repeated and continued heating. This could be explained on the assumption that any combined carbon originally in the casting decomposed into free graphite and free ferrite. The writer knew of no reason for assuming that carbon was combining with the iron during this process. Why then, were increased wearing qualities produced by "case hardening?" Was the function of the carburizing material simply to prevent oxidation? Did the quenching treatment merely harden whatever pearlitic areas there were in the original casting, or did some of the carbon in the casting or the carburizing material actually combine with the iron? Was the process similar to the production of chilled castings? If not, could any advantage be claimed for "case hardened" castings over the more common chilled castings? Would they have any advantages over malleable castings? These are some of the questions that the author has started to investigate.

Material

The experiments, herein described, were conducted on samples cut from three sand cast test bars of the following chemical composition.

	Bar No. 1	Bar No. 2	Bar No. 3
Silicon	2.12	2.41	2.49
Sulphur	0.073	0.073	0.107
Manganese	0.72	0.59	0.63
Phosphorus	0.367	0.635	.....

These bars were about 1 in. square and were cut into samples ½ in. thick, with the exception of two samples, hereafter mentioned, which were ⅜ in. thick.

Each sample was given the number of the bar from which it was cut, and in addition was given an individual letter. Thus samples 1A and 1B are the first and second samples respectively from bar No. 1.

Four samples each from bars 1 and 2 were packed in pipes with an ordinary carburizing material such as commonly used in case hardening steel. Two samples from each of these bars were packed in sand in another pipe. The ends of this pipe were protected from outside oxygen by thin layers of charcoal. All of the pipes were sealed with fire clay, placed in a hot furnace and run for three hours at 1,700 deg. F. At the conclusion of this heat they were given different treatments described in the data tables. Four other samples from each of these bars were heat treated in the open furnace as described in detail in the tables.

After studying the results of these tests another series of tests was run. In this test, four samples from bar No. 3 were packed in a pipe with a carburizing material as before, and run for 8 hours at 1,700 deg. F. This pipe was placed horizontally in the furnace. Toward the end of the heat it was noted that the seal was leaking. This may explain some of the results mentioned later. Another sample from bar No. 3 was placed in the middle of a ball of fire clay, and heated in the open furnace for 3 hours at 1,700 deg. F. At the conclusion of this time it was allowed to cool slowly in the furnace.

After heat treating, the specimens were all cleaned

Abstract of a paper presented before the annual convention of the American Society for Steel Treating, Pittsburgh, Oct. 8-12, 1923.

and tested under the Shore scleroscope. The Brinell method was tried on one or two, but it was found that the samples were too brittle for this test. All of them which could be cut with a hand hacksaw were so sectioned. They are listed in the data tables as hard or soft on the basis of their ability to be cut with a hacksaw. The speciments were placed one at a time in a vice and struck with a 3-lb. hand hammer. This was given as a crude test of their toughness. All of the samples were polished and examined under the microscope both before and after etching with picric acid. One sample from each bar went through all of these tests in the sand cast, untreated condition. The results are given in the data tables, and in the text following.

Hardness—It will be noted that all specimens quenched from temperatures above 1,500 deg. F. were too hard to saw and showed a scleroscope reading above 55.

Toughness—The most startling thing about all the results was the extreme variation from great toughness to great brittleness on the different specimens. The

Table I

Heat Treatments and Results on Samples from Bar No. 1

Sample	Heat Treatment	Hardness Shore	Hardness Saw	Toughness
1A	Sand cast; no treatment	45	Soft	Brittle
1B	Carburized 3 hr., cooled slowly	40	Soft	Brittle
1C	Carburized 3 hr., cooled slowly; reheated to 1,500 deg. F.; quenched in water	65	Hard	Fairly tough
1D	Carburized 3 hr., quenched in oil directly	75	Hard	Brittle
1E	Carburized 3 hr., quenched in oil; reheated to 1,500 deg. F.; quenched in water	68	Hard	Brittle
1H	Heated 3 hr. at 1,700 deg. F. in sand; quenched in oil	62	Fairly hard	Brittle
1I	Heated 3 hr. at 1,700 deg. F. in sand; quenched in water	62	Fairly hard	Brittle
1J	Heated to 1,700 deg. F. in open furnace; quenched in water	72	Hard	.....
1K	Heated to 1,700 deg. F. in open furnace; quenched in oil	68	Hard	Brittle
1L	Heated to 1,420 deg. F. in open furnace; quenched in water	47	Soft	Brittle
1M	Heated to 1,500 deg. F. in open furnace; quenched in water	72	Hard	Brittle

samples which were tested in the sand-cast condition were all easily broken. Unfortunately there were no available means of making quantitative shock tests on specimens of this size. Simple testing by placing the specimen in a vise and hitting with a 3-lb. hand hammer, is so crude that it is difficult to describe the results. Suffice it to say that the only ones which could be called tough at all were the ones which were heated in the carburizing material, slowly cooled, reheated to 1,500 deg. F. and quenched in water. All of the specimens so treated showed some resistence to the hammer. The most startling variation was found between specimens 3C and 3G. Both of these were slabs $\frac{3}{8}$ in. thick, from the same bar. Specimen 3G was in the sand-cast condition, while 3C had been carburized, cooled, reheated and quenched. The former was broken by one hard blow of the 3-lb. hammer, while 3C could not be broken by numerous blows. A $\frac{3}{32}$-in. V-groove was then ground and filed in this sample, and it was again struck with the 3-lb. hammer, but again it failed to break. After several attempts it was broken with a 10-lb. sledge. The other samples which received the same heat treatment

Table II

Heat Treatments and Results on Samples from Bar No. 2

Sample	Heat Treatment	Hardness Shore	Hardness Saw	Toughness
2A	Sand cast; no treatment	45	Soft	Brittle
2B	Carburized 3 hr., cooled slowly	39	Soft	Brittle
2C	Carburized 3 hr., quenched in oil	77	Hard	Brittle
2E	Carburized 3 hr., quenched in oil reheated to 1,500 deg. F.; quenched in water	63	Hard	Brittle
2G	Carburized 3 hr., cooled slowly; reheated to 1,500 deg. F.; quenched in water	55	Hard	Tough
2H	Heated 3 hr. at 1,700 deg. F. in sand; quenched in oil	55	Hard	Brittle
2I	Heated to 1,700 deg. F. in open furnace; quenched in water	55	Hard	Brittle
2J	Heated to 1,700 deg. F. in open furnace; quenched in water	80	Hard	Brittle
2K	Heated to 1,700 deg. F. in open furnace; quenched in oil	70	Hard	Brittle
2L	Heated to 1,420 deg. F. in open furnace; quenched in water	47	Soft	Brittle
2M	Heated to 1,500 deg. F. in open furnace; quenched in water	68	Hard	Brittle

were only $\frac{1}{4}$ in. thick and consequently were easily broken. The specimens which were simply heated in the open furnace, particularly to the higher temperatures, shattered quite easily when hit with a hammer.

The fractures of the original castings were gray. Some of the specimens quenched from the higher temperatures showed very light fractures which were very coarse-grained. As already mentioned these were very brittle. The samples which were cooled slowly all showed gray fractures. Some of the specimens which were carburized, cooled, reheated and quenched showed a difference in the fracture between the center and the outer layers somewhat similar to the difference between the

Table III

Heat Treatment and Results on Samples from Bar No. 3

Sample	Heat Treatment	Hardness Shore	Hardness Saw	Toughness
3A	Carburized 8 hr., cooled slowly; reheated to 1,500 deg. F.; quenched in water	70	Hard	Tough
3B	Carburized 8 hr., cooled slowly	35	Soft	.....
3C	Carburized 8 hr., cooled slowly; reheated to 1,500 def. F.; quenched in water	70	Hard	Very tough
3D	Carburized 8 hr., cooled slowly	..	.....	.....
3E	Sand cast; no treatment	45	Soft	Brittle
3G	Sand cast; no treatment.	.....	.....	.....
3H	Heated for 3 hr. at 1,700 deg. F. in clay; cooled slowly	45	Soft	.....

Note—By the term "Carburized" used in these tables, and in connection with the photographs, it is meant that the specimen so labelled was heated in a caburizing material to 1,700 deg. F. without regard to whether the process is true carburization or not.

case and the core of a case hardened steel specimen. The difference was not so pronounced as in the case of steel. The fracture was not as light as some of the specimens quenched from the higher temperatures. Specimen 3C showed a very fine grayish fracture.

This paper is not complete and exhaustive enough to be the basis for any final conclusions. There are many things yet to be worked out. Future work may alter the opinions which would be drawn from this paper alone. The paper does demonstrate the possibility of greatly improving the quality of gray cast iron. The best samples in this series were hard and at the same time had a toughness almost comparable with that of a case hardened low carbon steel. They were considerably stiffer than malleable castings. It would seem that the production of such a combination of properties from cheap gray cast iron, might have considerable commercial value.

There may be differences of opinion as to exactly what took place, during the "carburizing" heat, as well as the reasons for them. In the first place it seemed quite evident that the combined carbon in the center decomposed into ferrite and graphite. In other words, the action was the familiar malleablizing annealing, except that the amount of combined carbon in the original casting was lower than customary. This meant that the decomposition or annealing did not require as much time. The carbon, however, which was in the plate form in the original casting was inclined to remain in that condition. This could not be considered an advantage. It was shown that sample 3C after heat treating contained graphite mostly in the globular form. Two other photographs of heat treated samples from bar No. 3 showed the same condition. The writer does not see the explanation.

Other Questions for Speculation

What happens in the outer zones of these pieces when heated in contact with a carburizing material, may also be open to speculation. At the end of the run it is noted that the outer layer is mostly pearlite. Of course there was considerable pearlite in the casting to begin with. It would be interesting to try the same process on a cast iron containing as little combined carbon as possible. It seems probable that the combined carbon in the outer zone is actually increased by the "carburizing" run. Why should this take place? Does the pressure or quantity of carbon monoxide gas in the carburizing box, produce a different condition of chemical equilibrium with which a higher amount of combined carbon in the outer zone, is in balance? Why should heating favor decomposition of the combined carbon in the center and the formation of the same compound near the surface?

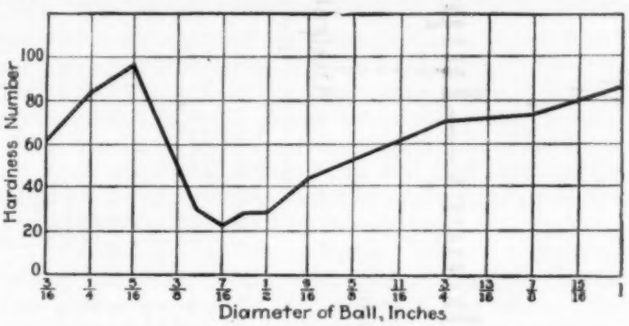
Another question which may well be raised, is; what composition of cast iron would be the most suitable. If the silicon is very high and the combined carbon very low, it might be possible that the excess of graphitic carbon might retain the plate form which would mean a weakness. Again if the silicon were very high would it not prevent the formation of pearlite in the outer zone? If the silicon were very low there would be a great deal of combined carbon in the casting to begin with. This might require considerable heating to break down and toughen. Also, if the silicon were low, would it favor the formation of excessive combined carbon in the outer zone and cause brittleness?

Testing Steel Balls for Hardness

By Major Johnstone-Taylor
Shrewsbury, England

In ONE well-known British factory devoted to the manufacture of ball bearings, after the balls have been hardened preparatory to grinding, a crushing test is applied to a certain percentage of each batch, this test being done in a hydraulic press.

Each ball is crushed separately between a pair of hardened steel dies, the pressure being noted on the hydraulic gage. Bags are wrapped around the dies



VARIATION OF THE SCLEROSCOPE HARDNESS NUMBER WITH THE SIZE OF THE BALL

before pressure is put on, and provision is made to protect the inspectors by the use of a movable steel guard, as the balls burst with almost explosive force.

A peculiar feature of this crushing test is that, should a ball be subjected to a greater pressure than about half the ultimate crushing pressure and then be removed from the machine, it will in a short period of time, which may vary from a few minutes to several hours, suddenly and spontaneously fly to pieces.

The crushed fragments are interesting. At the points between which the pressure is applied sharp-pointed cones of crushed metal seem to be formed; and it is the driving of these cones into the body of the ball which appears to be the ultimate cause of the bursting.

The scleroscope test, it may be mentioned, is of practically no use in the testing of steel balls, the rebound of the hammer which gives the reading being too far dependent upon the size of the ball. The scleroscope number, moreover, is not by any means a simple function of the size of the ball even though the hardness is uniform. Small balls give a high number, which diminishes to a minimum for balls about $\frac{7}{16}$ in. in diameter, and then increases more slowly as the size of the ball increases.

The actual scleroscope readings of a series of balls gradually increasing from $\frac{1}{16}$ to 1 in. in diameter and all of equal hardness within commercial limits, are shown in the chart herewith. The shape of the curve is remarkable. The value for a $\frac{1}{16}$-in. ball is just about the same as would be obtained for a ball of equal size, but soft.

The reason for this peculiar result of the scleroscope test when applied to balls is not yet fully explained. It would, however, appear to be due to the reflecting back of the pressure wave produced by the blow, the reactive effect on the hammer depending upon the phase of the returning wave, which in turn depends upon the size of the ball. Hence the adoption of the crushing test, which has proved quite satisfactory.

World Trade in Metal Working Machinery—Imports

Bureau of Foreign and Domestic Commerce
Prepared by Industrial Machinery Division,

United States, 1922

Supplement to table published on page 772, Vol. 57

Countries	
Austria-Hungary	$ 1,464
Belgium	88
France	....
Germany	199,400
Greece	....
Italy	297
Netherlands	....
Norway	144
Sweden	12,417
Switzerland	7,977
England	19,241
Scotland	....
Denmark	....
Spain	....
Canada	7,077
Honduras	....
Panama	....
Mexico	....
Cuba	....
Argentina	....
British West Indies	....
China	....
British India	....
Japan	....
Australia	....
Union of South Africa	....
Total	$248,165

Italy, 1920

Supplement to table published on page 43, Vol. 58

Countries	Lire
Austria-Hungary	10,886,500*
Argentina	9,800
Belgium	365,700
Czecho-Slovakia	683,300
France	2,997,700
Germany	56,113,900
Great Britain	11,521,700
Greece	54,600
Netherlands	93,000
Hungary	101,500
Sweden	341,900
Switzerland	8,811,000
Egypt	.....
United States	19,024,700
Malta	.....
Spain	.....
Denmark	230,800
Turkey	.....
Other Countries	20,500
Total	111,258,600†

Par value of Lira is 19.30c.
Quintali = 100 Kilograms.
*Austria only.
†2 quintali and 2,000 lire re-imports of Italian machinery exported included in this total.

Australia, 1921-22

Supplement to table published on page 266, Vol. 58

Countries	£
United Kingdom	1,034,324
Canada	3,776
New Zealand	458
British India	.....
Other British Possessions	.....
Austria-Hungary	.....
Belgium	11,116
France	8,888
Germany	53,931
Italy	126
Netherlands	1,354
Sweden	21,330
Switzerland	5,969
Norway	660
Denmark	157
Russia	.....
United States of America	527,555
Hawaiian Islands	.....
Other Foreign Countries	5
Share of Importing States:	
New South Wales	507,220
Victoria	711,204
Queensland	34,732
South Australia	81,615
Western Australia	70,170
Tasmania	264,708
Northern Territory	.....
Total of Imports	1,669,649

Union of South Africa, 1922

Supplement to table published on page 152, Vol. 58

Countries	£
United Kingdom	4,182
Canada	6
France	18
Germany	887
Sweden	152
Switzerland	....
Holland	75
United States	2,060
Total	7,380

THESE tables are the last of a number of supplementary tables published in Vol. 59, pages 22, 42, 134, 170 and 212. They are supplementary to statistics on World Trade in Metal Working Machinery from 1909 to 1921, published in Vol. 57, pages 730, 731, 772, 804, 805, 840, 876, 877, 924, 958, 959, 1003, and Vol. 58, pages 43, 82, 112, 152, 188, 225 and 266. It is expected that additional figures on exports and imports will be published from time to time as they become available.

Progress in Gear Standardization

Résumé of the work of the sub-committees of the American Gear Manufacturers Association and report of action taken at the Fall meeting, October, 1923

OF THE sixteen committees on technical standardization, nine submitted reports previous to the fall meeting, and in every case those reports were distributed to the membership. The reports showed various degrees of advancement in the work of the committees, from progress to recommendations.

The Spur Gear and Nomenclature Committees presented recommendations, copies of which were distributed at the meeting and there discussed. Definite action will be taken at the Spring meeting.

The Worm Gear Committee made definite recommendations which were accepted as recommended practice. The object of the recommendations is to reduce in number the worm hobs which are carried in stock by the various member-companies. It is well known that there are hundreds, and perhaps thousands, of hobs in use. Almost all cases would be covered if these thousands were reduced to hundreds, and perhaps fewer. The committee's report not only makes recommendations for new designs, but also makes recommendations for use in connection with hobs already in existence.

The Bevel Gear Committee made recommendations in regard to bevel gear nomenclature and submitted a "Graphic Picturization" of the terms used and defined. The report was returned to the committee with suggestions for changes, and it is expected that the revised report will be offered at the Spring meeting.

The Inspection Committee made only a progress report. This committee now has in mind recommendations as to methods for testing, on the lantern and otherwise, the various types of cutters which are used in cutting gears. It has also considered the subject of raw material inspection, working in conjunction with the metallurgical committee.

The Sprocket Wheel Committee made a definite recommendation for "Standards for Transmission Chains and Sprockets." The recommendation is the same as that submitted by the joint committee of the Society of Automotive Engineers, the American Society of Mechanical Engineers and the American Gear Manufacturers Association, as made public in *Mechanical Engineering* for August, 1923. The recommendation was accepted as recommended practice.

The Metallurgical Committee, which in the past has been so very active, was unable, for the best of reasons, to make more than a progress report, but has under way recommendations which will be of great value to every manufacturer and user of gears. A definite progress report will be ready in the Spring.

The Composition Gearing Committee offered as a standard a revision of the original "Composition Gearing Standard" which was first adopted in October, 1919. The revision cuts out much of the reading matter which accompanied the original standard and which described how the tables were to be used. At this time the tables are self-explanatory. The revised standard was accepted as read. It has been approved by the sectional committee and later will be submitted to the sponsor societies for their approval and still later to the American engineering standards committee, providing the approval of the sponsors is obtained.

The Keyway Committee offered a definite recommendation, but owing to the distribution among the members at so late a date no definite action was taken. This committee has been working in conjunction with the A. S. M. E., and will continue to do so until such time as a standard agreeable to the manufacturer as well as the user is obtained.

The Tooth Form Committee made definite recommendations along some lines and only tentative ones along others. It is probable that these recommendations will furnish a basis of definite work during the winter.

The Nomenclature Committee made a progress report. It is interesting to note that the work of the different committees in connection with the nomenclature of gears has developed over 60 definitions which have met with the approval of the sectional committee and which will soon be given to the technical press for publication.

The Library Committee, which has been dormant for some three years, submitted a plan to publish, from time to time, tables in loose-leaf form, which can be filed away in some standard loose-leaf book, and which, eventually, will produce an authoritative manual.

The Herringbone Gear Committee, the *Committee on Electric Railway and Mine Gears*, the *Differential Committee* and *Transmission Committee* made only progress reports.

Since January the *Sectional Committee*, which is composed largely of members of the two sponsor societies, namely, the American Society of Mechanical Engineers and the American Gear Manufacturers Association, has held two meetings, one last January and one in September, where the nomenclature of gears was considered very largely at both metings and some 60 definitions approved. The sectional committee will consider at its next meeting tentative standards for stub tooth gearing as submitted by the French and Dutch engineering societies. It appears at this time that the question of a stub tooth standard is of interest to the users of gears all over the world, and we believe that a recommendation can be made in the very near future, which will be the basis of a future standard.

It is of interest to note that the sectional committee has recently been enlarged to include representatives from other societies, and that the work of this committee is receiving more attention from users of gears.

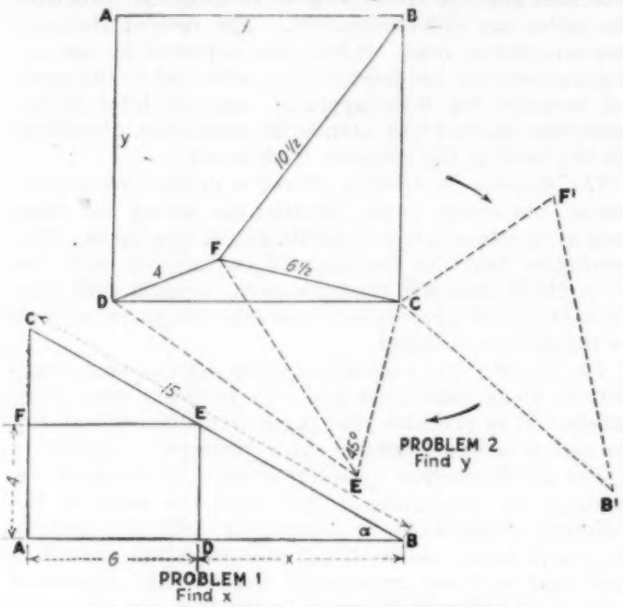
Prepared by B. F. Waterman, of the Brown & Sharpe Mfg. Co., Chairman of the General Standardization Committee and the A.G.M.A. Sectional Committee of the American Engineering Standards Committee.

Trigonometry Problems from the Drafting Room—Discussion

By A. L. De Leeuw

THE solutions given by Mr. Stevins on page 178 of the *American Machinist* to the problems presented by Mr. Thompson on page 652, Vol. 58, are all right from a purely mathematical standpoint, but may be a little over the heads of some people. I am inclined to think that there are some draftsmen, good ones too, who do not know any more about the solution of an equation of the fourth degree than they know about the fourth dimension, and who do not have even a bowing acquaintance with Messrs. Euler and Lagrange.

I believe that the solutions of problems such as these



TWO PROBLEMS IN TRIGONOMETRY

should be along simple lines, requiring only such knowledge as every draftsman should have and being well within reach of most shopmen who have studied their shop mathematics. In this particular case such simple solutions can be given. I propose to start with Problem 2, the sketch for which is here given.

If we imagine triangle *BCF* swung around point *C*, as indicated by the arrow, until line *BC* coincides with *CD*, we obtain figure *DFCE*.

$\angle FCE = 90$ deg. because $\angle DCE$ is the same as $\angle FCB$;

$FC = 6\frac{1}{2}$ and $CE = 6\frac{1}{2}$. Therefore

$EF = 6\frac{1}{2}\sqrt{2}$ and $\angle EFC = 45$ degrees.

We know all three sides of ΔDFE and therefore can calculate $\angle DFE$. There are two well known ways to do this. If we call S half the sum of the three sides of the triangle, we have

$$\sin DFE = \frac{2}{DF \times EF} \times \sqrt{S\,(S - DF)\,(S - EF)\,(S - DE)}$$

from which we can find $\angle DFE$.

We know *DF*, *CF* and the included angle *DFC*, which allows us to find *DC* by applying the formula:

$$DC^2 = DF^2 + CF^2 - 2DF \times CF \times \cos DFC.$$

The above method of finding $\angle DFE$ is particularly good when the dimensions of the sides are unwieldly, because the formula permits the direct application of logarithms. Where the figures are simple, as they are in this case, the angle *DFE* can be found by the use of the formula

$$\cos DFE = \frac{DF^2 + EF^2 - DE^2}{2DF \times EF}$$

This solution goes step by step, requires no solution of equations of high power and is within reach of anyone with an elementary knowledge of trigonometry.

As to Problem 1, it is still simpler, though it requires a little more patience and, perhaps, time.

$$EB = 4 \text{ cosec } \alpha$$
$$CE = 6 \text{ sec } \alpha$$

Adding,

$$EB + CE = 4 \text{ cosec } \alpha + 6 \text{ sec } \alpha$$
$$BC = 15 = 4 \text{ cosec } \alpha + 6 \text{ sec } \alpha$$

We see from the sketch that α is less than 45 deg. We will make a guess as to its approximate value. It is possibly somewhere between 30 and 40 deg. Taking our table of natural functions we find:

sec 30° = 1.1547	6 sec 30° = 6.9282
cosec 30° = 2.0000	4 cosec 30° = 8.0000
	14.9282 — (too small).
sec 40° = 1.3054	6 sec 40° = 7.8324
cosec 40° = 1.5557	4 cosec 40° = 6.2228
	14.0552 — (too small).

This work shows that our guess was incorrect. The angle must be less than 30 deg. It shows also that it is not far from that value. Trying 29 deg.,

sec 29° = 1.1433	6 sec 29° = 6.8598
cosec 29° = 2.0627	4 cosec 29° = 8.2508
	15.1106 — (too large).

The angle is therefore somewhere between 29 and 30 deg. and somewhat nearer to the latter. We shall try 29 deg. 45 min.

sec 29° 45′ = 1.1518	6 sec 29° 45′ = 6.0108
cosec 29° 45′ = 2.0152	4 cosec 29° 45′ = 8.0608
	14.9716 — (too small).

One, or at the worst two more trials will give the angle correct to within one minute. Further trials will give the angle, as correct as the scope of the table of natural functions permits. Having the angle, the other elements of the figure can be easily found.

This method can often be profitably applied in machine design; for instance, when calculating the helix angle of two helical gears with shafts at right angles to each other, and which must have a given pitch and center distance.

Safety Code for Aeronautics

Definite steps are being taken to increase the safety of aviation by the adoption of a safety code, as is in effect in other industries. The work is being done by the Bureau of Standards, the Society of Automotive Engineers and the American Engineering Standards Committee. The code will include the following parts, as representing different phases of aeronautic work: Scope and Nomenclature, Airplane Structure, Powerplants, Equipment and Maintenance of Airplanes, Signals, Airdromes and Airways, Traffic Rules, Qualifications for Pilots, Balloons, Airships and Parachutes.

This is a most important work and with the passage of a Federal bill for licensing both pilots and planes, will do much for the safety of aviation. Copies can be had from the Society of Automotive Engineers.

Factors Governing "Out-of-Roundness" Measurement

By A. H. FRAUENTHAL

Types of "out-of-roundness"—Measurement by the 3-point system and V-block method — V-block and other methods for checking elliptical forms — Instrument improvement suggestions

ACCURATE measurement of "out-of-roundness" is an important item of inspection that, it seems, has not received due consideration even in our larger plants which use the most modern of measuring instruments. It is an item that affects quantity, quality and cost of production. If, through a fallacy of inspection methods, parts are produced and accepted for production that exceed the specified limits, there is generally a falling-off of production due to the difficulty of assembling parts in this condition, and the quality certainly is lowered through the loss of bearing area. On the other hand, if parts that are actually within the specified limits are rejected and scrapped, the decrease in quantity of production and the increase in cost of production are obvious.

The two different general types of out-of-roundness are "regular" and "irregular."

The irregular class comprises those objects which assume an irregular shape and, consequently, will not be governed by any set rules for their inspection. Under this head are parts that become out-of-round due to distortion in heat-treatment, crowding of tools by hard spots, and the like.

The regular class is composed of those objects the high and the low-pots of which manifest some mathematical continuity. Since the objects do contain high-spots and low-spots, their sections are no longer circles and must not be treated as such. If the object contains two diametrically opposite high-spots and two diametrically opposed low-spots, its section is an ellipse; and, if it contains a greater number of high-spots and low-spots and we consider the low-spots as sides and the high-spots as vertices, the section becomes either a triangle, a square or some other polygon. The paper deals with this latter class of out-of-roundness.

Out-of-Roundness Characteristic of Certain Machines

Automobile parts, such as piston-pins, small shafts, valve-lifters, shackle-bolts, roller-bearing pins and many other similar parts, are generally ground on centerless grinders. It has been determined, on work that comes out-of-round from a centerless grinder, that the quantity of high-spots and low-spots is always a number that is a multiple of 3. This condition is, no doubt, due to the fact that the centerless grinder has three points of pressure on the part being ground; namely, the grinding wheel, the feed wheel and the work support. On the other hand the number of high-spots and low-spots on work that comes out-of-round from the ordinary grinder employing centers generally is a multiple of 2. This is doubtless due to the two points of pressure on the piece being ground; namely, the centers and the grinding wheel.

Other machines also produce out-of-round work, particularly gear-driven machinery on which the number of high-spots or low-spots is equal to a multiple or factor of the number of teeth is one of the gears or the train of gears. Due to the varied shapes which an out-of-round piece may take, it is necessary to use different types of checking apparatus to determine the true conditions of each differently shaped piece.

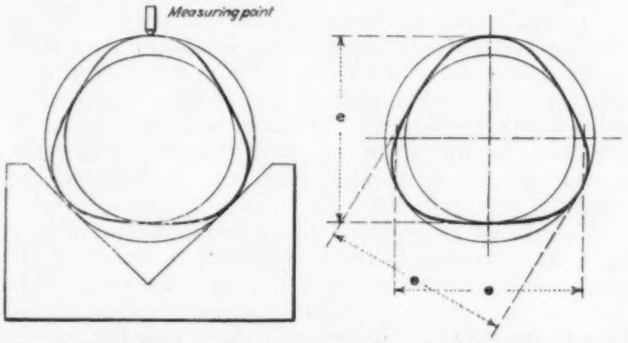


FIG. 1—OUT-OF-ROUND OBJECT OF TRIANGULAR SHAPE

A cylindrical object, the out-of-roundness of which is greatly exaggerated, is shown in Fig. 1. This is shown in the shape of a triangle and is the empirical form in which out-of-roundness manifests itself from the centerless grinder. It can be seen readily that if a checking method employing directly opposed measuring points were used on a piece of this shape, it might appear absolutely round; whereas, it actually could be considerably out-of-round. This is due to the fact that one of the measuring points would be located on a low-point, while the one directly opposite would be located on a high-point. Since the actual amount of out-of-roundness of any piece is the difference in the diameters of the inscribed and circumscribed circles, it is necessary to use a measuring apparatus that registers in three places in the case of triangular objects.

Various three-point measuring-tools are on the market and, since their application and results are all approximately the same, we may use for an example the V-block method as employed with any of the numerous

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amplifying gages, such as the one shown in Fig. 2. The amplifying gage is merely an apparatus that employs a lever system to increase the movement of a measuring point held in contact with the work, and an indicator to measure the increased movement. While there are various different gages on the market, the principle of all is the same and with most of them are furnished different types of work supports, such as centers, V-blocks or flat plates.

To the casual observer, this method may appear to

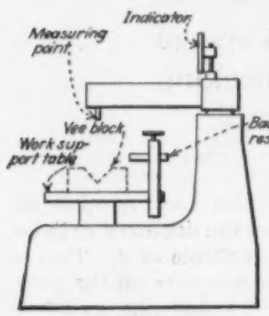


Fig. 2

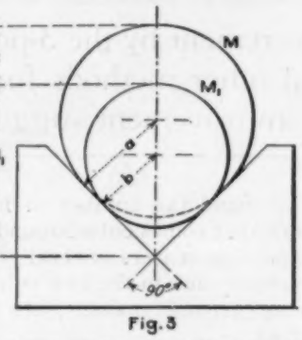


Fig. 3

FIG. 2—MEASURING INSTRUMENT WITH V-BLOCK AND AMPLIFYING GAGE. FIG. 3—INSCRIBED AND CIRCUMSCRIBED CIRCLES IN V-BLOCK

give accurate results; but such is actually not the case and, for each different included angle of the V, a different correction must be applied to the indicator reading. This correction is obtained by very simple mathematics and we will demonstrate the necessary correction on a V-block having a 90-deg. included-angle, since this is the angle universally accepted for commercial V-blocks.

It would be incorrect to use a 90-deg.-angle V-block for a piece containing three high-spots, since the high-spots would be indexed 120 deg. from each other, thus requiring a V-block having a 120-deg. included-angle. This is merely an empirical example of how the correc tion is obtained; it is, therefore, permissible, and the correction can be used when inspecting diametrical variations on parts within the tolerance for out-of-roundness.

Inasmuch as the V-block method will, at some time or other, while the piece is being revolved, present the inscribed circle to the three registering points and, at some other time, present the circumscribed circle to the three registering points, we can use any two circles of selected diameter and find out how much higher one will set in the V-block than the other. This figure, minus the actual difference in diameters, is the amount of the correction. The diagram in Fig. 3 shows two circles in a V-block as suggested.

If D represents the diameter of the large circle and D_1 the diameter of the small one, the following expressions are easily determined:

$$D = 2a;\ D_1 = 2b;$$
$$H = a + \sqrt{2a^2};\ H_1 = b + \sqrt{2b^2};$$
$$x = (a + \sqrt{2a^2}) - (b + \sqrt{2b^2});$$
$$2x = (D + \sqrt{2D^2}) - (D_1 + \sqrt{2D_1^2});$$
$$x = 1.2071\ (D - D_1).$$

The last equation shows that the difference in readings at M and M_1 will be 1.2071 times the actual difference in diameters. In other words, on account of this exaggeration, a correction of approximately 21 per cent must be applied.

The V-block method already described often is used erroneously on work for which the character of out-of-roundness has not been determined previously. The use of this method with elliptical objects is shown in Fig. 4. If we designate the major radius by a and the minor radius by b, using the symbol m for the slope of the V, it is evident that the straight line, $y = mx + k$, is tangent to the ellipse if $k = \pm \sqrt{a^2m^2 + b^2}$.

We know that the line is tangent and that $m = +1$, therefore,

$$k = \pm \sqrt{a^2 + b^2};$$
$$V = \cos 45\ \sqrt{a^2 + b^2} = 0.70711\sqrt{a^2 + b^2};$$
$$H = V + a;\ H_1 = V + b;$$
$$x = H - H_1 = (0.70111\sqrt{a^2 - b^2} + a) - (0.70711\sqrt{a^2 - b^2} + b) = a - b.$$

This value of x is the indicated amount of out-of-roundness, but the actual amount is, of course, $2a - 2b = 2\ (a - b)$. The indicated amount is therefore only half of the actual difference between the major and minor diameters, and this method introduces an error of 50 per cent.

Fig. 5 shows a cylinder with the out-of-roundness in the elliptical form and exaggerated greatly. Inasmuch as the amount of out-of-roundness of any object is the difference in the diameters of the inscribed and circumscribed circles, it would be a very easy matter to measure this difference on the part shown merely by applying some measuring instrument with opposed measuring points, such as the micrometer caliper, to the distances a and b.

However, the micrometer caliper is no longer used for quantity inspection of work of this type, and has been replaced by the amplifying gage. The reasons for this are familiar to all, or are very obvious at least, and do not require discussion here.

In a manner analogous to that of the micrometer,

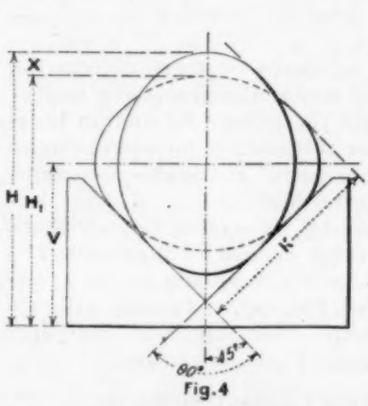


Fig. 4

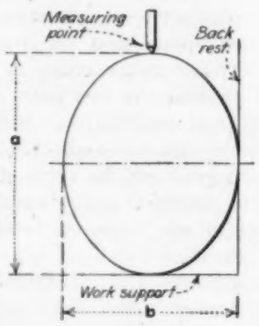


Fig. 5

FIG. 4—ELLIPTICAL OBJECT IN THE V-BLOCK. FIG. 5—ELLIPTICAL CYLINDER IN THE AMPLIFYING RANGE

the piece could be moved back and forth, horizontally, under the measuring point, until the highest and the lowest readings were obtained. This is a very accurate method, but is, unfortunately, slow. To overcome the difficulty of finding the highest and the lowest points and to eliminate the horizontal motion, which requires considerable time, the back-rest has been added as shown. When using this appliance, the original indicator-setting is made by a pluggage or master-piece which is moved back and forth under the measuring point until the highest reading is obtained.

The position of highest reading is, of course, at the diameter of the circle and, with this obtained, the back-rest is moved-up to the master-piece and fastened in place. In the actual inspection, the piece being tested is held firmly against the back-rest and revolved under the measuring point. This method is very rapid; however, it adds a third measuring-point to the combination and hence requires analysis to determine whether the indicator readings require correction.

To determine this, let us first assume that the amplifying gage is in perfect condition as received from the

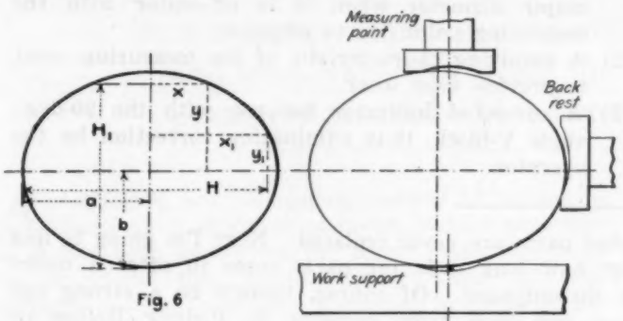


Fig. 6 Fig. 7

FIG. 6—DIAGRAM TO DETERMINE AMPLIFYING GAGE ERROR. FIG. 7—MEASUREMENT CONDITIONS WITH WORN MEASURING POINTS

manufacturer; that is, with the back-rest and the work-support perfectly flat and the measuring point rounded to give point contact and to permit the specimens to slide under the point readily. The elliptical piece is revolved as has been described and, when the lowest indicator-reading is obtained, the major diameter of the ellipse naturally will be horizontal, with one extremity against the back-rest, as shown in Fig. 6. This condition, of course, brings the measuring point off the center and the reading obtained is smaller than the actual minor-diameter. The amount that it is smaller depends on two quantities, the actual amount of out-of-roundness, which is unknown, and the degree of curvature of the measuring point.

When the highest indicator-reading is obtained, the conditions are just the same in effect, a smaller reading than the major diameter is obtained, and the amount that it is smaller depends on the same conditions. Although, with a perfect ellipse, the measuring point is the same amount off-center when taking the highest reading as it is when taking the lowest reading, the difference in readings, which is the indicated amount of out-of-roundness is not exactly the actual amount of out-of-roundness, even though we were able to procure point contact at the measuring point, which would eliminate the complication of the radius. It is, however, so nearly the correct amount that the method would be perfectly safe to use, even on so close a job as piston-pins, if it were possible to obtain the perfect conditions just described. However, it must be remembered that all readings, whether used in checking roundness or size variations, will be complicated by the radius on the measuring point. To overcome this condition, trials should be made periodically with known-diameter master-pieces to obtain corrections for radius and wear of the measuring-point radius.

The amount of error in the reading of both the highest and lowest points is found as follows, the readings being indicated by H and H_1 as before. If we designate the major radius by a and the minor radius by b, it is evident that the amount which the measuring point is off center is $\frac{a-b}{2}$. The equation of the ellipse is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$x = \frac{a-b}{2}$$

$$y = \pm\frac{b}{2a}\sqrt{3a^2 + 2ab - b^2}$$

$$H_1 = b + y = b \pm \frac{b}{2a}\sqrt{3a^2 + 2ab - b^2}$$

The equation of the ellipse in the other position is $\frac{x_1^2}{a^2} + \frac{y_1^2}{b^2} = 1$ and, by substituting the value of $y_1 = \frac{a-b}{2}$, it is found that

$$x_1 = \pm\frac{a}{2b}\sqrt{3b^2 + 2ba - a^2}$$

$$H = a + x_1 = a \pm \frac{a}{2b}\sqrt{3b^2 + 2ba - a^2}$$

$$H - H_1 = a - b \pm \frac{a}{2b}\sqrt{3b^2 + 2ba - a^2} \pm \frac{b}{2a}\sqrt{3a^2 + 2ab - b^2}.$$

This equation shows the amount of error in the reading of both the highest and the lowest points and, although this particular error is very large, their difference in readings is very close to the actual amount the specimen is out-of-round. Unfortunately, the formula for the corrections comes out in an involved form that does not permit us to show the percentage of error readily. However, the correction necessary, due to the complications of the radius on the measuring point, is greater than the foregoing correction.

Now let us suppose that the instrument is not absolutely new but has seen enough service to show some slight wear on the three registering points; the support-plate, the back-rest and the measuring point. After 2,000 pieces are measured on one of these machines, the wear is evident even though the points subjected to wear show a scleroscope hardness as high as 90. This is a natural condition, as the pressure is very concentrated due to the bearing at all three points being a point of tangency.

Errors from Worn Points

The conditions shown in Fig. 7 now take place. With the major-diameter horizontal, the point of contact with the back-rest is either off the lowest point on the edge of, or entirely outside, the worn groove; this results in a lower reading than the true reading, due to the abnormal amount the measuring point is off-center. On the work-support, the piece is again either off the lowest point on the edge of, or entirely out of, the worn groove; this results also in a higher reading than the true reading, and the same condition is true at the measuring point. Hence, we see that one worn point contributes to a lower reading, while the two other worn points contribute to a higher reading. With the specimen in position with the major-diameter vertical, the results obtained are similar. The amount of error in the indicator-readings depends again on two quantities; the amount of out-of-round and the amount of wear. Inasmuch as the former quantity is unknown and the latter unknown or at least varying constantly, the results obtained cannot be corrected by any set

mathematical formula and the correction must be obtained by checking with known-diameter master-pieces in the manner described.

This discussion demonstrates that an out-of-round surface requires a checking instrument having opposed measuring-points if the number of high-spots is even and a checking instrument with 3-point contact with one point located on the center-line between the other two if the number of high-spots is uneven.

Another word of caution may be added concerning the use of the 3-point method. For close work, the angle between the three points of contact must be selected according to the number of high-spots. This is due to the fact that the high-spots are not points, nor the low-spots straight-lines, and it easily is possible to select an angle that would not register on either the highest or lowest points.

This paper is not to be taken as an indictment against these various methods of inspection or even an implication that these methods are not the best that have been yet brought forward. It is meant to point out that the various indicator-readings require correction to produce correct results. It was also intended to bring out the fact that there is still considerable room for improvement of these instruments to eliminate some of our present difficulties. In connection with this, I suggest three items that probably are worthy of consideration by the manufacturers:

(1) A flat measuring-point large enough to reach the major diameter when it is off-center with the measuring point due to ellipticity.
(2) A revolving characteristic of the measuring point to provide even wear.
(3) A corrected indicator for use with the 90-deg.-angle V-block, thus eliminating correction by the operator.

The Cost of Carrying Spare Parts

By John R. Godfrey

"WHAT do you know about the cost of carrying spare parts, Godfrey." said old man Johnson the other day.

It didn't take long to tell him.

"Well, you know what a howl there is about the cost of spares on some motors. I've hollered myself and would do it again, likely as not. But there are two sides to the question.

"Do you remember those special motors we built, say twenty years ago? Trouble was we built 'em too dern good. They've stood the gaff for years, with only an occasional break and when some customer wires in for a new part he expects to get it by return express, and for about ten cents a pound at that.

"If it were new stuff that we were making right along I agree that it ought not to cost a young fortune for a ¾ bolt and nut. I believe it pays to sell such parts at a small profit so as to keep the cost of upkeep as low as possible.

Parts for Obsolete Motors

"But when it's a part for a motor that you built fifteen years ago and that hasn't been in production for over ten years, the fair price to charge is quite a different matter. We've got altogether too many parts of motors on hand that are out of date and are not called for more than once in a blue moon.

"Of course, we want to be able to help a customer keep his motor going but we can't afford to lose money doing it. There's a crankshaft which cost us thirty dollars by the time it got into the stockroom. It's been there ten years, taking up valuable space, having to be handled and inventoried every year, and eating its head off in interest and other charges. Yet we are supposed to sell that to a customer for the same price we quoted ten years ago.

"We've got thousands of dollars tied up in just such stuff as that and probably fifty per cent of it will be here at the end of the next ten years, whether I am or not. Now what's the answer, Godfrey? There's got to be a change in our notion of what things ought to cost in cases like that.

"I'm going to have Tom make up a list of the spare parts we've sold and see what parts wear out first and what parts are never replaced. Next I'm going to find out how long calls for parts come in after a model is discontinued. Of course, there'll be a strong call now and then from someone in Podunk Hollow or Goosebery Bend, long after most of the motors of the same vintage have gone the way of all scrap. But they are not going to count with me as much in the future as they have in the past. I want to do the square thing in supplying parts, but the Johnson Motor Co. has got to get a square deal, too.

"I figure that ten years is a liberal allowance for the life of even a Johnson motor, and we are not going to carry spares beyond the ten-year period. We'll just let the spares run out at the end of ten years, as nearly as we can figure it. Any parts ordered after ten years are to be made to order and charged accordingly. We won't see how much we can stick 'em up, but they're going to cost more than just production prices.

"Tom wants me to agree to a plan for increasing the price of spares after a five-year period, to cover cost of storage, of handling in yearly inventory, of interest and what not. It isn't a bad scheme and it's sure logical, but I'm not quite sure how it will hit a customer. The chances are he'd rather pay a little higher flat price from the beginning than feel that he was being penalized for taking such good care of his motor that it lasted over the five years. But I'm glad Tom has an idea once in a while whether we can use it or not. I'd rather have him think wrong once in a while than not to think at all."

This spare parts problem is a puzzle for many a concern and there may be a kind of solution in not trying to carry parts for machines over ten years old, for motors at least. This of itself might help to solve the used motor problem and to encourage people to buy new motors.

Some of the confusion arising in the designing and building of large machinery can be eliminated by following the practice of the Westinghouse Electric & Manufacturing Co. and dimensioning everything in inches. The use of "feet" was abandoned some years ago and since this change much of the confusion and many of the errors formerly existing have disappeared. There may be places where the sole use of inches will run into figures which are difficult to grasp and to handle, but in most cases it is a very sane and sensible move.

Tempering Tools By Steam at High Pressure

BY ELLSWORTH SHELDON
New England Editor, *American Machinist*

A unique method of tempering—Relation between pressure and temperature of steam the basis—Perfect control of temperatures assured—Has been in operation for many years

A UNIQUE and interesting method of tempering small tools by means of steam at high pressures has been in service for many years in one of the prominent tool manufacturing shops of New England, but has now been discarded in favor of oil-tempering baths, not because of any defect or failure to secure uniformity of results but solely because it is believed that the more modern oil-bath will effect a saving in time. Indeed, for ease and certainty of temperature control the discarded method could not be improved upon.

As every one associated in any way with steam engineering knows, the temperature of saturated steam bears a definite and inviolate relation to its pressure. So certain is this relation that it is quite practicable to gage, accurately, the pressure upon a steam boiler by means of a thermometer, or to read, with equal accuracy, its temperature from a steam gage. In the apparatus here illustrated and described the steam gage is the only temperature registering instrument employed.

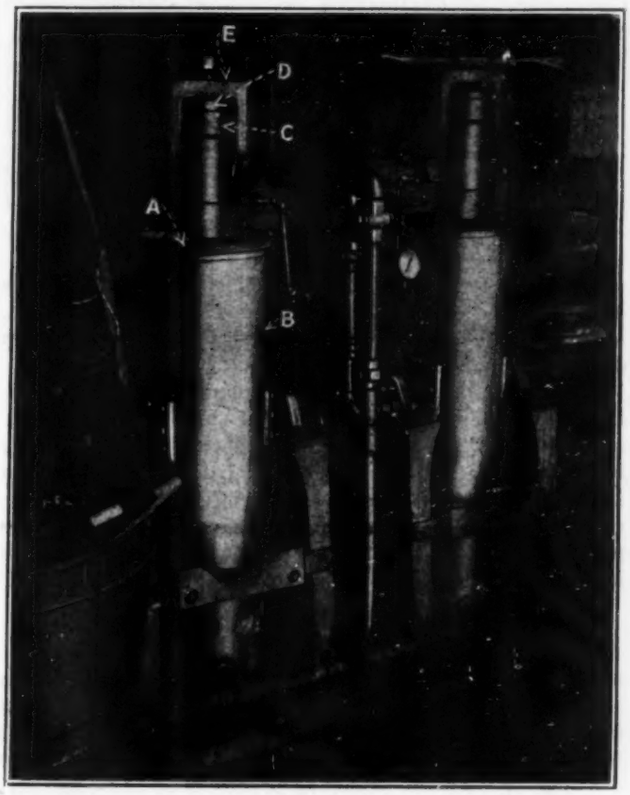
Tubes Used as Generators

Two separate units are shown in the illustration. Each consists of a piece of extra heavy wrought-iron tube about 4 in. in internal diameter by 6 ft. long. Only a small portion of the upper ends of these tubes are visible in the picture, as that portion of the tube below the cast iron flange *A* is concealed by the asbestos-lined sheet-metal jacket *B* that serves to confine the heat generated by a gas burner located within the jacket at the lower end.

The tube is closed, by welding, at the bottom to form a hemispherical end. It is open at the upper end, where it is surrounded by the wrought-iron collar *C*, also welded to the tube. The open end is accurately countersunk to form a conical seat for a steel plug, *D*, that is ground to a steamtight joint, and held to its seat by the clamping screw and forged yoke *E*, which gets its hold under the collar *C* by its inwardly projecting ends.

Except for the ⅛-in. steam pipe tapped into the side of the tube and leading to the steam gage, there are no connections or openings into the tube after the plug has been seated. All other pipes to be seen in the picture are gas-pipes, leading to the burners. In the gage pipe there is a lever-operated value, the sole duty of which is to release the steam pressure when the desired temperature has been reached.

The whole apparatus is swung upon trunnions so that it may be tilted to an angle considerably below the horizontal plane for the purpose of dumping out the work after the tempering has been completed. The gas burner is built into the lower end of the jacket in such manner that the act of swinging the apparatus



APPARATUS FOR TEMPERING BY STEAM PRESSURE

to an upright position brings the burner into proper relation with the gas nozzle without making any pipe connections.

To introduce a charge of work the clamp and plug are removed and the tube tilted to a convenient angle. The number of pieces introduced does not matter; the tube may be full, or it may contain only two or three pieces without affecting the results obtained. After the work has been put in, the tube is swung upright and about a pint of water poured in. The plug is then secured in place and the burner fired.

The amount of water put into the tube depends some-

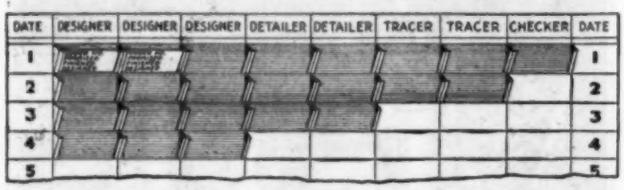
what upon the quantity of work it contains, and is judged by the operator's experience. Too much water would have no effect upon the resulting temper of the tools but would unduly increase the length of time required to raise the required pressure. Too little water would result in its being entirely converted to steam before the desired pressure was reached, and the steam would then take on a super-heat that the gage would not register. The consequence of such an error would inevitably be an overdraw, and the operator is therefore always careful to make his error, if any, in the direction of an over supply of water in the tube.

The time required for drawing the temper of a charge of work is from 10 to 20 min. (approximately). The pressures employed vary from 325 to 400 lb. per sq.in., according to the size and nature of the tools. The pressure rises slowly at first and the operator is not constrained to give his entire attention to the apparatus until the gage approaches the predetermined figure. When this is reached he shuts off the gas and opens the relief valve, thus releasing the pressure and reducing the temperature of the container to 212 deg. at once.

Efficiency in the Engineering Department

By Warren P. Willet

MUCH has been said and done in the interest of industrial efficiency, but unfortunately these activities have for the most part been confined to actual production and the so-called "non-operating" departments have received very little attention. Most seriously has the engineering branch of industry been neglected. This department, which plans and advises efficient and economical means of mechanical production, is often least efficient and economical in the use of its own time.



SCHEDULE BOARD FOR AN ENGINEERING DEPARTMENT

In the factory, by intelligent planning and scheduling, the man's work is ready for him as soon as he is ready for it. There is no lost motion and no waiting between jobs. Why not apply a little of this system in the engineering department? A few improved methods which have been established in one engineering department may be of interest and assist others in this important task.

Lost Time Causes

Upon analyzing one organization it was found that not all of the lost time was the result of dilatory habits and absences, deplorable as these things are, but a large part of it was due to the men not knowing what to do next, or in not knowing how to do the work in conformity with the standard practices of the company. Instead of proceeding from one job to another without interruption it was necessary for the men to go frequently to the chief engineer for instructions, and very often several men were at his desk waiting for work to be assigned them. This gave him very little time to go over his orders and assign work according to a man's ability. Finally his position became that of keeping the men busy rather than the more important function of supervising the engineering work.

This unsystematic practice became obsolete when a work schedule was established, and supplemented with a schedule board on which all work was posted in plain sight. The board was marked in vertical columns and horizontal lines forming rectangles, into each of which was set an open-front card retainer as shown in the accompanying illustration. A column was arranged for each man and headed by his name. Along a vertical column at the extreme left of the board was placed a series of numbers representing the days of the month.

A small card bearing a work order number can be placed in one of the designers' columns opposite the required date, its progress followed throughout the several stages, and finally after checking, be removed from the last retainer. Then, after entering upon the card the date of completion and other data as required, it may be filed away for future reference.

By this means the chief engineer knows at all times the status of his work. If a piece is falling behind schedule it is quickly detected by the location of the card with reference to the dates in the column, and if necessary, extra men can be used to catch up.

As for the writing of the cards, that is taken care of by a boy who simply copies from the written orders, the order number, the type of machine and the promised date of delivery. The chief engineer having indicated by whom the designing should be done, the cards are placed in a retainer under the indicated name and opposite the proper date.

Standardization of Reference Sheets

Like other departments of this kind we had a large collection of reference sheets containing the data of our manufacturing practices and, unfortunately, the usual disorderly arrangement of such sheets existed. As no uniformity was followed as to size of sheets, they were contained in some four or five folders. This made it difficult to know in which folder the required information was to be found and, as there was but one set, they were in great demand.

As a matter of standardization, all data was transferred to eight and one half by eleven inch sheets. This size is very convenient, as much of the data can be made up on the typewriter. Some of the more simple drawings in the sets were redrawn to this size but the more complex ones were reduced by means of the photostat. Several copies were made and each man was provided with a neat, compact set of standard data sheets in loose-leaf form which was complete in itself. This eliminated the necessity of several men trying to refer to the same book at once. The books are kept up to date by adding to or taking from, as the occasion requires, so that every man has before him at all times accurate and reliable information.

By this means searching for a data book which was generally in use was not only avoided but, as the men became familiar with the contents of their books, they found in them answers to many questions which, otherwise, would have taken up the time of the chief engineer.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Convenient Ball Chuck

By Frank C. Hudson

Among the products of the Pioneer Instrument Co., Brooklyn, N. Y., is what is known as a turn-indicator, an instrument which contains a small air-driven gyroscope that tells the airplane pilot the instant he begins to turn from his true course. The case of this instrument is an aluminum cylinder, as shown in Fig. 1, and in order to secure a wall of uniform thickness it is necessary to hold it by the inside cored surface during the turning operation.

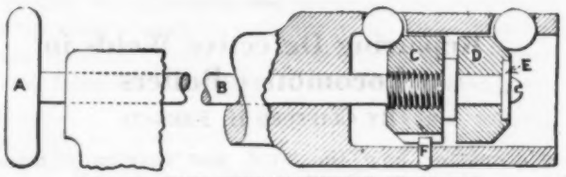


FIG. 3—HOW THE MANDREL IS MADE

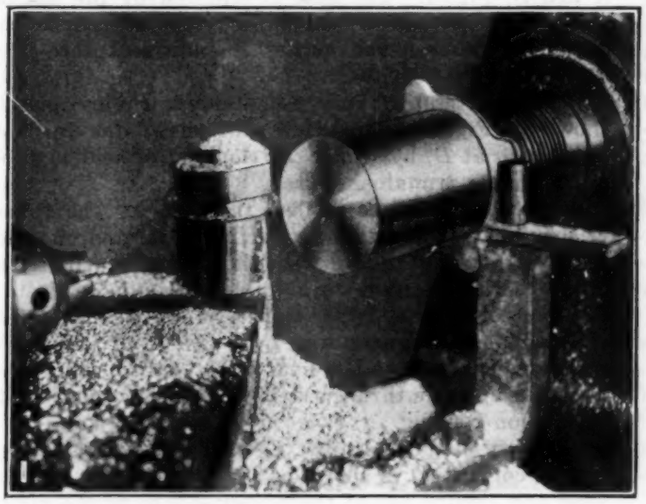


FIG. 1—TURNING CASE FOR GYRO TURN-INDICATOR.

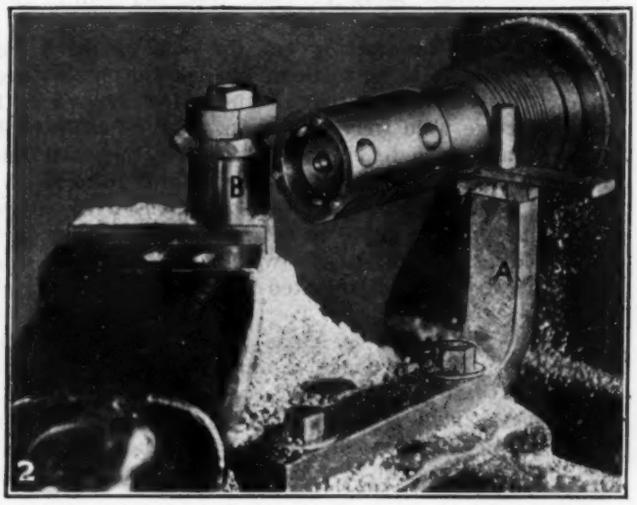


FIG. 2—THE BALL MANDREL WHICH HOLDS THE CASE

To chuck the cases quickly and accurately the superintendent, B. C. Goldsborough, designed the ball chuck shown herewith. There are six balls in all, in two sets of three balls each, so that the case is held on three points at both the front and back ends. Each set of three balls is controlled by a separate cone, as shown in Fig. 3.

The handle *A* is on a draw-in or chucking rod *B*, which controls both cones *C* and *D*. The rod is threaded into cone *C* while cone *D* has a plain hole but is held against end motion by the collar between the cones and a washer *E* at the end, held in place by a screw. The rod *B* is free to float endwise through the spindle and move the two cones with relation to each other, by means of the screw. The cone *C* is prevented from turning by means of the pin *F* which works in a slot. This makes a quick-acting chuck or mandrel that has proved very satisfactory in every way.

The tooling for the cases is interesting both for its simplicity and effectiveness. The improvised toolpost at *A*, Fig. 2, carries a simple tool which faces the back of the flange. The front toolpost *B*, carries two equally simple tools which turn the outside and face the end and the front side of the flange at the one setting. Suitable stops on the bed, gage both the diameter and the length and make this plain engine lathe do duty as a special machine set up for this job. When the cases go through in lots of from 50 to 200, the time saved by this device is very noticeable.

Modern Speeds for Turning Tires

By I. B. Rich

Machine shop men who are not familiar with the quality of the steel used in locomotive tires do not appreciate how hard they are to turn. If they did they would be more chary of their criticisms as to slow turning speeds. Cast iron or machinery steel can be turned at 40 ft. a min. or more in some cases, but let the lathe hand try to secure anything like this speed on tires for locomotives and see what happens.

We have a new wheel lathe of the latest design and we can sometimes get a speed as high as 15 ft. a min. This is the exception, however, as 12 to 14 ft. per min. is about all we can boast of. And this seems to be the economical speed when all things are considered.

When a wheel skids on the rails, it seems to harden up the contact spot and the surrounding metal. These spots are frequently so hard as to be almost unturnable. In one case we recently used up five roughing tools on one pair of 62-in. flat wheels.

Just to show what can be done under good conditions,

I may mention one railroad shop in which 32 pairs of 33-in. wheels were turned out in 8 hr. The cutting speed was 15 ft. per min. and our average output is 27 pairs in 8 hr. The makers of the lathe think we are running it too fast but it's still on the job. We keep a bunch of roughing tools already ground near the lathe at all times and we change tools the minute one shows distress of any kind. Otherwise we could not get such production.

Repairing Defective Welds in Locomotive Boilers

By Clifford H. French

No matter how the weld was originally made all deposited metal must be cut out of a defective weld and considerable more on each side, depending upon the length of the defect and its location.

The reason for cutting out the weld on each side of the defect is to equalize the contraction stress over a length greater than that of the defect repaired. If the defective weld were only 2 in. long it would probably be advisable to chip out 4 to 6 in. on each side, thus making a total length of new weld of 10 to 14 in.

It is advisable also to preheat the old weld several inches beyond the place to be gas welded before starting welding. Then, as the weld metal cools the contraction stress is distributed over the comparatively wide space.

If the attempt were made to simply cut out the defective weld and make a new gas weld, the probability is that the weld would crack in cooling. But if we have a large gas weld it will possess sufficient strength to draw the sheets while contracting in spite of the resistance of the sheet stiffness and the staybolts.

These suggestions regarding the repair of defective welds apply to both gas and electric welds which have developed defects. The defective seam must in all cases be rewelded for some distance each side of the defect, in order to make a sound dependable job.

Fixture for Drilling Differential Cases

By Chester H. Franklin

Probably the most important point in machining the cases for differential gears is to have the holes for the pinion bearings at right angles with those for the axle. The fixture used for this purpose by the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., is rather unusual in design and is particularly interesting from the fact that it is easily handled and secures thoroughly satisfactory results.

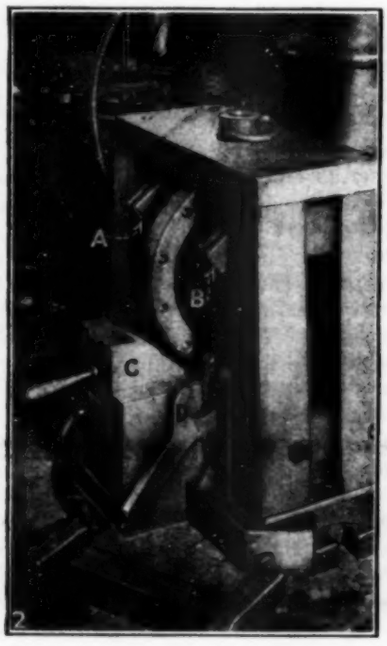
The fixture is shown in Figs. 1 and 2, the former showing a case in drilling position, and the latter with the guide and latches withdrawn for the removal of the work.

The trunnions at each end of the case rest in suitable V-blocks and are clamped in position by the straps *A* and *B*, Fig. 1. The case is centered by the sliding block *C*, which has a central slot that surrounds the flange of the case and locates it endwise before it is clamped in the bearing.

Clamps *A* and *B*, and wedge block *C*, are plainly shown in Fig. 2. This view also shows the form of hook latch at *D*, by which the clamps are held in position over the trunnions.

After the holes are drilled, the seat for the thrust washer is finished with a flat facing cutter and, in order to have this seat square with the pinion bearings, the pinion holes are used as a guide and stop in facing. The bar *A*, Fig. 3, is positioned in the facing tool at right angles to its axis and rests in two of the pinion bearings, as shown. The final facing cut is then taken, which insures the thrust bearing face being square with the pinion bearing.

The very simple form of "go" and "no-go" gage used in this connection is shown at *B*. This gage is a hardened and ground bar of the proper size to fit the pinion bearings, and carries two sets of gage pins. These pins are in reality continuous pins going through the bar, but the ends of each pin are ground and lapped to the proper radius, so that the pins on one side act as a "go" and those on the other side as a "no-go" gage.



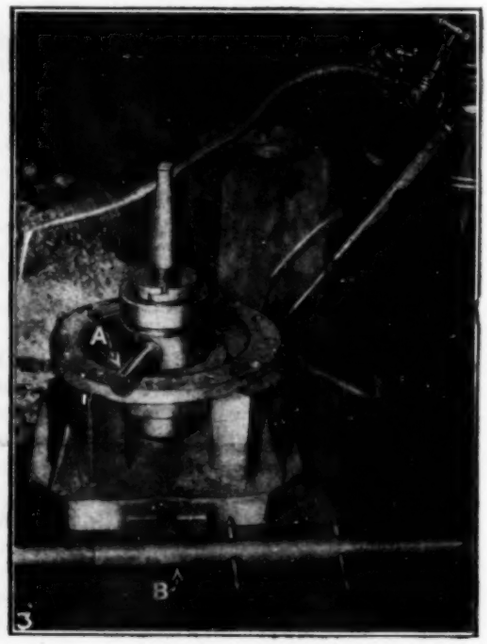
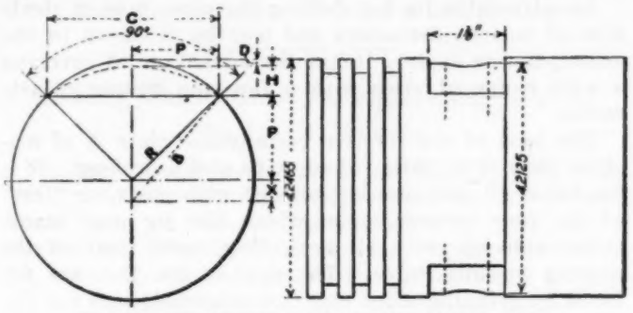


FIG. 1—DIFFERENTIAL CASE IN POSITION FOR DRILLING. FIG. 2—CASE READY TO BE REMOVED. FIG. 3—FACING CUTTER AND PIN GAGE

Computing Offset for Relief Grinding

By Clarence D. Scrom

Our engineering department has specified a relief to be ground over each end of the piston wristpin hole and, to locate the relieved section within 90 deg. of the piston circumference, it was necessary to build an offset grinding fixture. The design of the fixture gave considerable



RELIEF GRINDING ON AUTOMOBILE PISTON

trouble until the proper offset was computed by means of the formulas herewith.

In the figure, which shows the proper relief ground in a piston,

X = Offset to be determined.
C = Chord.
P = One-half the chord.
D = Depth of recess.
B = Radius of offset.
R = Radius of piston.

In the computations for determining the amount of the offset, three formulas are used in the order given.

$$H = R - P - D.$$

$$B = \tfrac{1}{2}\left(\frac{C^2}{4H} + H\right)$$

$$X = B - R + D.$$

Using the dimensions given in the figure, the computations for the value of X are as follows:

$$D = \frac{4.2465 - 4.2125}{2} = 0.017 \text{ in.}$$

$$P = R \sin 45 \text{ deg.} = 2.1232 \times 0.7071 = 1.5014 \text{ in.}$$

$$H = 2.1232 - 1.5014 - 0.017 = 0.6048 \text{ in.}$$

$$C = 2P = 2 \times 1.5014 = 3.0028 \text{ in.}$$

$$B = \tfrac{1}{2}\left(\frac{3.0028^2}{4 \times 0.6048} + 0.6048\right) = 2.166 \text{ in.}$$

$$X = 2.166 - 2.1232 + 0.017 = 0.0598 \text{ in. offset.}$$

An Affixing Bolt for Bridge and Ship Workers

By J. P. Towlson
London, England

On metal construction work, such as bridges, pontoons, and especially in iron ship-building, there is frequent need for a simple and reliable device for the temporary, though secure, holding of various fixtures, such as the standard for a ratchet or electric drill.

Of course a bolt may be put through any convenient hole and the fixture held by a nut on the outside, but this procedure requires the services of two men and may often involve considerable delay, for, if the part to which the fixture is to be secured be the deck or side of a ship, one man may have to go quite a distance and be obliged to climb into awkward or inaccessible positions in order to reach the other side of the plate.

The sketch, Fig. 1, shows an expanding head bolt that may be pushed through any plain hole and firmly fixed by the simple expedient of pushing in a pin. A hole of suitable size is drilled lengthwise through the center of the bolt and the bolt is slit over part of its length into two, three or four sections, like a spring collet.

When entered into the hole in the deck-plate the parts close together sufficiently to allow the head to pass through. The expanding pin is then pushed into place from the outside and effectively prevents the sec-

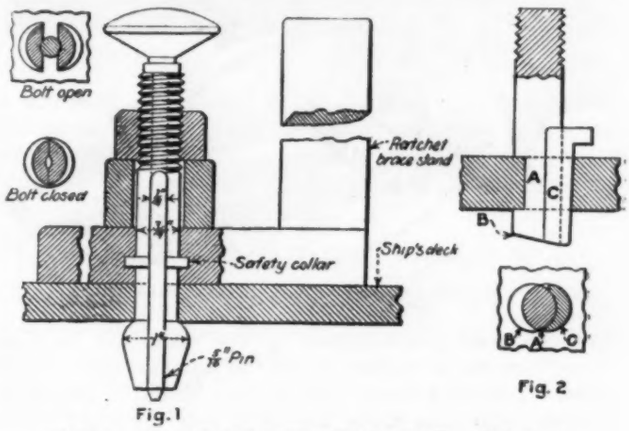


FIG. 1—AN EXPANDING HEAD BOLT. FIG. 2—A SIMPLER METHOD

tions from again closing as the pressure of the nut is applied.

Fig. 2 shows a somewhat simpler, though still effective, device for accomplishing the same purpose. A slot is cut crosswise of the body of the bolt near the end to correspond to the thickness of the deck-plate and when the bolt is entered in the hole a concaved faced key, driven into the hole beside it, forces the slot into engagement with the plate and prevents the bolt from being drawn out by the pressure of the nut.

Who Knows of This Drilling Compound?

By William Arnett

A tramp machinist once came to a shop where I was employed, and was put at work drilling holes in some pieces of spring steel, the material of which was so hard that it could not be punched. He was very successful on a job whereupon all of us had failed, and the secret of his success was in the compound that he used on the drill.

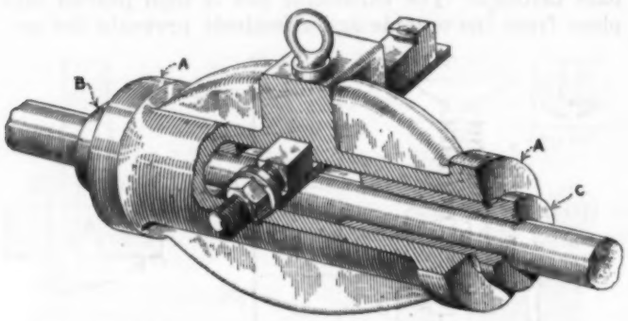
He was very reticent as to the nature of his compound and no one could find out of what it was composed until, one day, he came to work in a somewhat intoxicated condition and some of the boys prevailed upon him to give the secret away. The formula is as follows:

Dissolve a quarter's worth of camphor gum in a half-pint of alcohol and add one half-pint of lard oil. With this compound on a file you can file window-glass. With a drill ground to the proper angle, and using this compound, plate glass can be drilled without breaking. It is the best thing I know of for drilling anything of a hard nature. Try it out before condemning it.

Straightening Bent Shafting in a Lathe—Discussion

By J. T. Towlson
London, England

The letter under the above title by Frank C. Hudson, on page 920, Vol. 58, of the *American Machinist*, touches a subject upon which there is need for enlightenment, for the average workman is much too likely to resort to the reprehensible practice of using the centers of a lathe as the point of resistance—with the result



DEVICE FOR STRAIGHTENING SHAFTS

that the good accomplished by the operation is often more than counterbalanced by the damage done to the lathe. I have always barred this practice whenever possible, and have made use of it only upon old lathes that were about ready for the scrap heap anyway.

I had occasion to straighten a good many shafts during the war. They were of chrome-vanadium steel, 2 in. in diameter by 10 ft. long, and were required to clean up to 1⅞ in. Many of these bars were sprung as much as ⅞ in., some of them having short bends. Time was a most important factor, and it was necessary not only to straighten the bars but to do it quickly and accurately.

The device I used for the straightening is shown in the accompanying sketch, and embodies practically the same principles as those set forth in Mr. Hudson's article. The body of the device was smoothly bored to 3 in. in diameter and the ends at *A* turned true. Sleeves *B* and *C* were turned to fit closely in the bore of the body and were bored to a free fit upon the bars.

The device was suspended from the hook of a light crane over the lathe. A bar would be passed through it and the loose sleeves passed onto the bar, when one end of the latter would be caught in the jaws of a universal chuck and the other allowed to lie in an open steadyrest.

Finding the worst bend in the bar, the body of the device would be centered upon it, the loose sleeves pushed in, and pressure applied by means of the wedge, which was drawn in by a 1-in. Whitworth-thread nut. The inner ends of the sleeves could be separated to any desired distance up to 10 in. as the bend was long or short, and the bending pressure applied without imparting any strain to the lathe.

After each application of pressure the lathe would be started and the device, now cast loose from the crane hook, allowed to rotate with the bar. The truly turned ends of the body thus served to show the condition of the bar with regard to straightness; if they ran true, the bar was "good enough."

The lathe was by no means an essential factor, as the device could be held at any convenient place and height by the crane while the straightening pressure was brought to bear upon the bends. The lathe was merely a convenience to determine where the bar ran out and when it was straight.

A Drill Jig for Clevis Pins

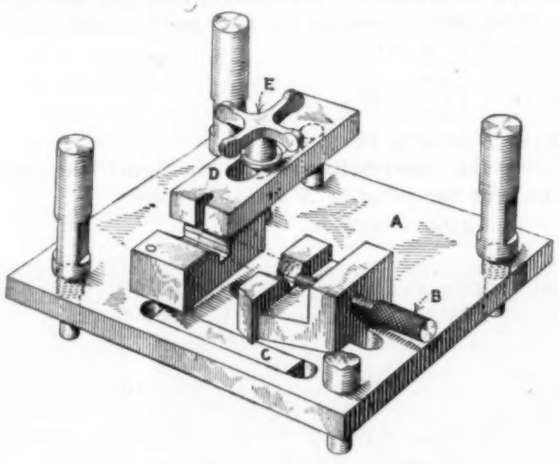
By A. Towler

An adjustable jig for drilling the cross hole in clevis pins of various diameters and lengths is shown in the accompanying sketch. It has the advantage of covering a wide range of sizes with a few and simple adjustments.

The base of the jig is a rectangular plate *A* of machine steel, ⅜ in. thick, 4½ in. wide and 6 in. long. It is machined all over and is provided with posts, or "feet" at the four corners, upon which the jig may stand, either side up, with all projecting parts clear of the drilling machine table. The ends of the feet are finished by grinding after they are assembled into the jig, to insure that the base shall stand parallel with the table in either position.

A pair of V-blocks serves to locate the work. One of the blocks is securely doweled to the base and the other, accurately in line with the first, is provided with a tongue upon the back that is fitted to slide in a shallow square-sectioned groove in the base, so that it may be moved to or from the fixed block without disturbing its alignment. It may be clamped in any position within its range by means of a single screw passing through an elongated slot in the plate.

The sliding block is made with a raised ledge at one



DRILL JIG FOR CLEVIS PINS

end, through which passes the knurled-head clamping screw *B*, to assist in locating and holding the work. A pointer, which is also a part of this block, extends over the graduated scale *C* on the base, and indicates directly the distance from the shoulder of the clevis pin that the cross hole is to be drilled.

A hole bored through the base plate and through the fixed block intersects the centerline of the V-groove and accommodates interchangeable bushings for the various sizes of drills. The drill bushing and the position of the sliding block are the only matters requiring attention when changing sizes of work.

The work to be drilled is held in the V-groove by a clamp *D*, which is tightened by means of the hand nut *E*. This clamp bears upon the work directly over

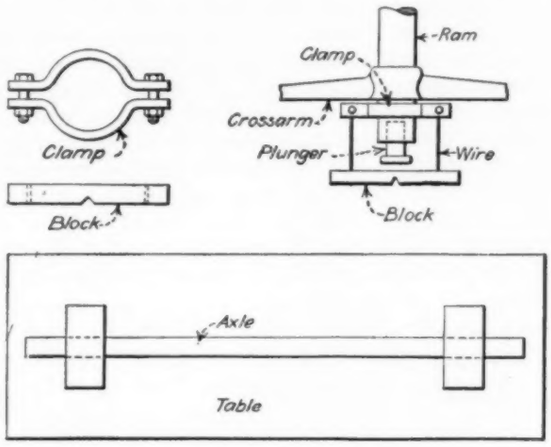
the drill bushing and thus sustains the drilling pressure.

With the sliding block adjusted to the proper position to accommodate the length of the work, as indicated by the pointer on the scale, and a bushing for the correct size of drill in place, a clevis pin is laid in the groove, the clamping screw *B* turned forward until the shoulder of the pin bears against the end of the sliding block, and the holding clamp is adjusted. The jig is then inverted and is ready for the drilling.

Saving Time on a Straightening Press

BY JAS. A. RODGERS

We use a Lucas power press for straightening axles and similar work, and it was customary for the operator to use a bar of 1¼-in. sq. steel, about 1 ft. long, with a V-notch for holding it in place on the upper side of the axle. By the old method it was necessary to pick



ATTACHING STRAIGHTENING BLOCK TO THE RAM

this bar up and place it on the axle every time the ram was brought down.

In order to save both time and labor, we fastened the block to the ram by means of a clamp and suitable wires, so as to form a flexible connection.

This arrangement allows the block to adjust itself on the work, and saves the operator from lifting the bar and placing it is position at every stroke of the press. The accompanying illustration shows how this was done.

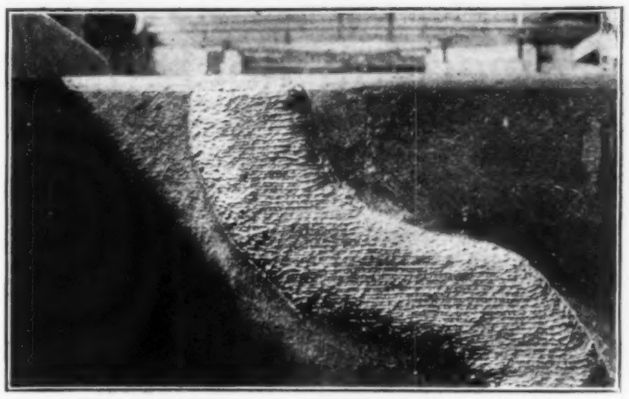
Repairing a Planer Bed

BY CHESTER H. FRANKLIN

Some time ago the Yoder Manufacturing Co. of Cleveland, Ohio, had a rather disastrous fire which, among other damage, cracked the bed of one of its largest planers in several places near the ends. Planers were not plentiful and time was limited so it was decided to repair the cracks with an oxy-acetylene torch. The illustration shows how one of these welds looked after completion.

The combination of the heat of the fire and of the torch, together with the sagging of the floors, left the planer decidedly out of line so that it became necessary to replane the V's before it could be used.

In order to do this the ram of a shaper was bolted to the planer table so that the tool head would project



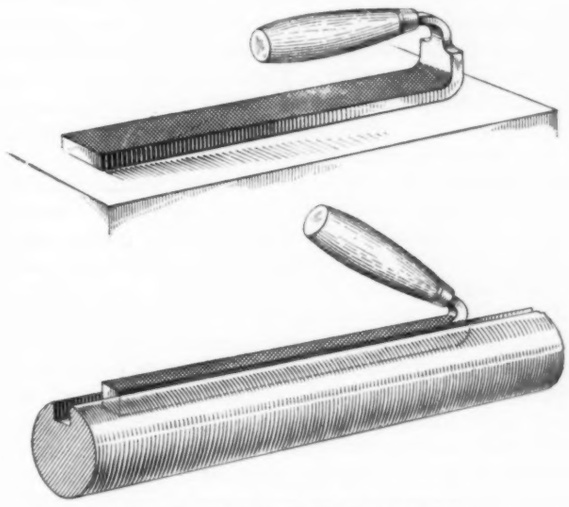
WELDING A CRACKED PLANER BED

a sufficient distance to plane off the high spots while the table was still running on that portion of the bed which was not distorted. In this way the V's were trued up and the planer again put into commission.

Inverted-Handle File for Special Work

BY G. A. LUERS

When filing broad flat surfaces or in slots or places below the surface of adjacent parts of a casting or forging, the usual handle of the file cannot be used. Special file holding devices and offset handles have been devised for the work under these conditions and are used to a large extent. An unusual but nevertheless serviceable and simple method of fitting a file for use under such conditions is shown in the attached sketch.



SIMPLE SURFACE FILE HANDLE

With this method the handle is in an elevated position, which makes possible the use of greater effort and the attainment of a considerable degree of accuracy.

The file is fitted for this use by annealing the metal adjacent to the tang and bending it, while heated, to the shape shown. The amount of bend and the position of the handle is made to suit conditions. In filing key slots or feathered keyways, a square file, bent accordingly, makes a very simple and convenient tool. The handle in the inverted or inclined position presents a convenient grip for the workman, while the work required to place the handle in this position is about as simple as could be desired.

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KENNETH H. CONDIT AND FRED H. COLVIN
Editors

November 8, 1923

The Automobile Industry and American Business

THE AVERAGE citizen of the United States has become so inured to the faculty of the automobile industry for breaking records of all kinds that he rather takes its big accomplishments for granted. Any information that leads to speculation on the size of the incomes of the Ford family is usually given first page space by the newspapers but facts of far more significance are passed over as relatively unimportant.

To the man who sells things to the automobile manufacturers the facts we have just mentioned have a deeper meaning. The statement that the industry is the biggest, or second biggest, consumer of hardwood lumber, of upholstery materials, of plate glass, gets right home to his pocketbook and interests him deeply.

In the first article, published last week, of our series, "What About Automobile Shops?" some figures on the mortality among the automobile manufacturers were included that looked rather gloomy if not carefully analyzed. We said at the beginning of the article that the failures probably had little effect on the productive capacity of the industry as a whole. Figures that have come into our hands since that article was published show just how small the effect was even in such a disastrous year as 1921. They indicate that probably not over four per cent of the total productive capacity as measured by dollar volume of sales was eliminated by the failure of manufacturers.

No wonder the industry occupies its present high position. That it is high, there can be no question. That it will remain so depends on the continued and well directed effort of the men responsible for production and distribution of its product.

Although distribution is somewhat out of our field we are convinced that great savings can be made in present-day distribution costs. When it comes to production, however, we believe that we can be of assistance. It is with this purpose in mind that the present series was undertaken. We expected to find progressive methods in use and we did find them. At the same time we also found some chances for improvements and they form the basis for the articles that are offered in the hope that they will be useful to the automobile production organizations.

Why Is A Stove Bolt?

AMONG the survivals of the dark ages in machine products the stove bolt stands out as a shining example. Originating in the days when bolts and screws were haphazard products, it had a square thread and a nut which only the mysteries of Providence prevented from dropping off. As an example of how loose a nut would stay on a bolt, it took the prize.

Then came the thread with sloping sides, on the order of what afterwards became known as the Acme thread, but the angle used varies through wide limits. The size of the head also varies as well, depending largely on whether the maker uses one or two blows in upsetting it. Eastern makers use the large head while those in the middle western districts stick to the small.

The uses of the stove bolt are, however, not confined to the making of stoves. The automobile industry among others uses far more than the stove makers. The National Screw Thread Commission has been carefully studying the problem for some time and it is coming to be the feeling among some of the members, that the stove bolt could be replaced by standard A. S. M. E. machine screws to the advantage of all concerned. They feel that the necessity for the stove bolt has disappeared and that the sooner it is discarded the better. Hence they are asking, "Why is a stove bolt?"

As eastern and western manufacturers of stove bolts are now agreed that the angle of thread should be 60 deg. as on other threaded work, the only differences now outstanding are on diameters and pitches, and these are insignificant. It is to be hoped, therefore, that when final specifications for thread and head dimensions of "National" or "American" machine screws are adopted by the Commission and the Sectional Committee they will be made to apply to all small metal fastening screws with nuts. whether used on stoves, automobiles, or elsewhere.

Coal Storage— A Major Problem

IT IS with the expectation of having available complete and unbiased data that we contemplate the study of the storage of coal by the Federated American Engineering Societies, whose final report will be ready about the first of the year. As was true in the investigation of waste in industry, made by the F.A.E.S., study of the coal storage problem is a gigantic task. More than 500 engineers are actively engaged in the work. Separate investigations to meet peculiar local conditions in various cities and districts are being made.

Mining operations are intermittent, causing heavy financial risk and a continuous aggravated labor problem to the operators, uncertain annual income and dissatisfaction to labor, high prices to the public, and inordinate burdens upon the railroads. The Engineering Coal Storage Committee, it was stated, "is of the opinion that a larger practice of the storage of coal would in a very significant measure reduce the degree of intermittent operations of the coal industry and therefore relieve the public of much of the evil that now prevails."

To set to work 500 engineers upon a problem of national importance is an accomplishment possible only to a society representing many engineering societies. It was with just such problems in mind that the organizers of the F.A.E.S. visioned the united societies, and the results from concentrated engineering effort are justifying the existence of the organization.

Standardizing Oil Well Casings

AMONG the projects of the National Screw Thread Commission is that of standardizing the threads of oil well casings. And though oil wells are confined to comparatively few sections of the country, it is difficult to find a more important piece of work, or one in which standardization is more urgently necessary. For whether we realize it or not, we are becoming more and more dependent on oil for all our activities. It is also very important from the point of view of national defense, for all branches of the service.

Some idea of the need for standardization may be had from the statement of one concern. This oil company has wells in three different fields and no two of them use well casing which will interchange. Each field seems to be a law unto itself, the kind and size of pipe and type of thread joint, apparently depending on the previous experience and personal inclination of the foreman in charge.

The cost of this lack of standardization can only be fully appreciated by those who have visited and studied the oil fields and become familiar with the cost of delays due to well casing fittings not going together as they should. Work of this kind is usually done under adverse conditions and when we are dealing with pipe lines which extend down into the earth from two to five thousand feet, the importance of having couplings fit can be readily appreciated.

A committee of the Mid Continent Oil and Gas Association is working on the problem of standardizing casing sizes and threaded joints and at the recommendation of the Thread Commission a beginning has already been made by the elimination of one of the tapers. Pipe tapers of $\frac{1}{16}$, $\frac{3}{4}$ and $\frac{1}{4}$ in. per ft. were formerly used but the $\frac{1}{16}$-in. taper has been abandoned. Furthermore there is to be a positive size at which the taper and number of threads per inch changes, instead of having different makers follow their own inclination as to the point at which the taper changes occur.

There can be no question as to the desirability of having oil well casing fittings interchange, in the same way as steam fittings. The demand for this standardization must come from the users of oil well casings. The sooner they realize the saving to be effected and co-operate with the National Screw Thread Commission in their endeavors, the sooner can standardization be brought about. The secretary of the Commission, H. W. Bearce, will be glad to give any further information desired and can be reached at the Bureau of Stand ards, Washington, D. C.

Prices of Machine Tools

MANY users of machine tools are still laboring under the delusion that prices are too high and that if they delay ordering they may again buy at about pre-war prices. A little consideration of all the costs that enter into the construction of machine tools, when compared with other products, will soon show the fallacy of hoping for pre-war prices. We have become accustomed to paying from twice to three times as much for many such necessities as shoes, clothes, coal and house rent as in 1914. We now consider seven or eight dollars as cheap for a pair of shoes that we formerly bought for four. And yet we kick because machine tools have not gone back to pre-war levels.

As a matter of fact the prices were never high enough except in a few instances. For it must be remembered that few machine tools can be built on a large scale production as with automobiles, washing machines and many other products. Being a basic industry on which all other manufacturing depends for its existence, tools must be constantly improved so as to turn out more and more work with less and less labor. New models are constantly demanded and standardization, except as to details, is out of the question.

The great trouble is that purchasers of machine tools became accustomed to getting altogether too much machine tool value for a dollar in pre-war days. Machine tools largely grew out of one-man shops, where the proprietor had formerly worked at the lathe and bench. He was content with day wages or a little better, not always realizing that overhead, interest and the cost of development had to be paid for by the customer.

For this reason the income of machine tool shops was not high enough to warrant paying good wages and the machine tool shops saw their best men go to the bicycle shops and then to the automobile industry, without being able to offer sufficient wages to keep them.

The machine tool industry needs the best mechanics in the country. It is to the interest of all other industries that it have them. But in order to get and to hold them, it must be able to pay as high or higher wages as other machine building shops. More than this, it must be able to attract young men who are now going into the building trades because of the money to be made in them.

If we are to have better machine tools, the shops building them must be able to get good men. To do this they must charge enough for their machines to be able to pay at least the prevailing rate of wages at all times. And buyers of machine tools should get over the delusion that prices must be lower before placing orders. For unless the machine tool industry can be maintained at its proper level, all manufacturing suffers.

The Fallacy of Imbedded Abrasive

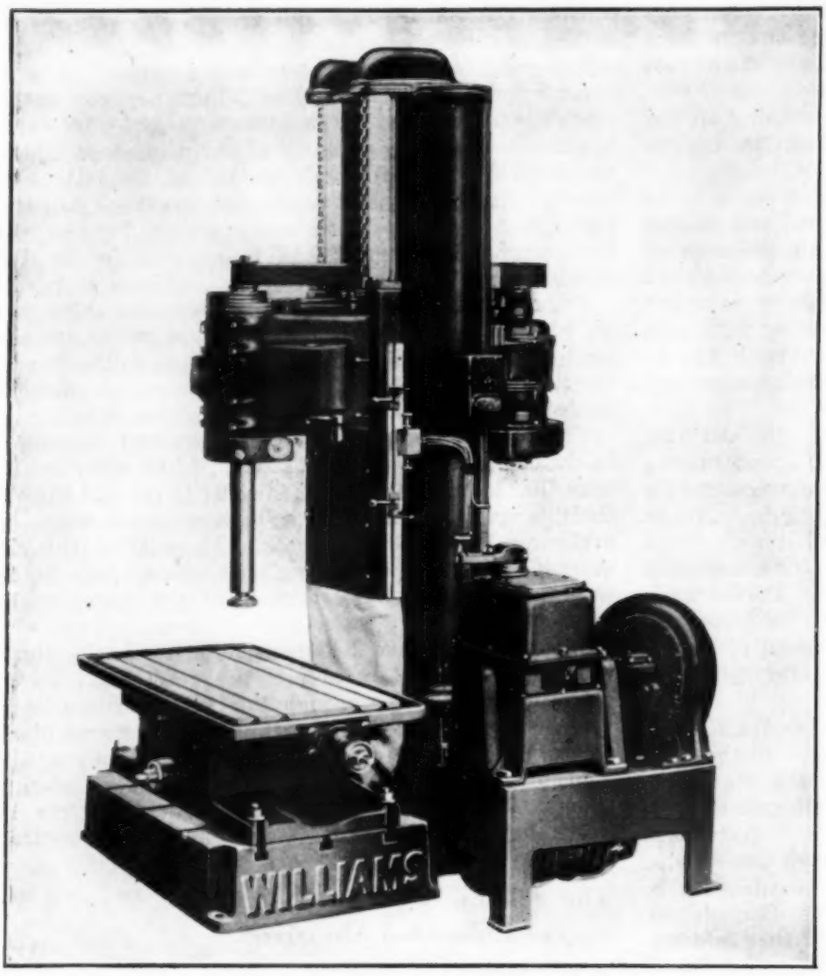
OCCASIONALLY, at ever greater intervals to be sure, someone offers as an objection to finishing cylinders by grinding, the argument that particles of abrasive become imbedded in the walls with later destructive results. The theory seems plausible and many people still give it credence.

There is a very simple way to check up on the action of the abrasive and that is to grind some cylinders and then examine them. A manufacturer of abrasive wheels and grinding machines has recently done just that, and the results brand the imbedding idea as a fallacy. A brief report of the tests is given on page 689 of this issue.

Shop Equipment News

Williams Vertical Cylinder Grinder

A vertical cylinder grinder which embodies several interesting arrangements for drive and control has recently been brought out by the Hi-Way Service Co., South Bend, Ind. The feed of the grinding head is accomplished by an Oilgear pump driven by a separate motor and mounted on a stand at the side of the column.



WILLIAMS VERTICAL CYLINDER GRINDER

The twin design column is cast in one piece with connecting sections at top and bottom, leaving an opening through which the motor arm projects from the grinding head. The ways on which the head travels are cast integral with the column, machined accurately and scraped.

The head is also a unit casting and contains all working parts. A 2-hp. vertical type motor running at 3,400 r.p.m. is mounted on an arm which projects through the column from the head. This motor is belted to the grinding spindle which rotates at a speed of 7,000 r.p.m. It is stated that this arrangement of the driving motor counterbalances the grinding head and tends to eliminate friction and wear in the ways.

The spindle is mounted in ball bearings and has an adjustable tapered bronze bearing at the lower end. A flexible idler is furnished to keep the 2½-in. belt at the proper tension, and speed changes are accomplished by changing pulleys on spindle and motor. The regular spindle is adapted to grind holes 2¾ in. in diam. and larger.

The arbor, in which the spindle is mounted, is made up of two eccentrics, by which the adjustment of the spindle center for planetary action is accomplished. The arbor is driven by an independent motor through a worm gear. The capacity of this horizontal type motor is ½ hp., and it has 2 speeds, 1,720 and 1,120 r.p.m. The starting, stopping, and speed changes are controlled by a drum type controller on the opposite side of the head. The dialing arrangement for adjusting the eccentric is located below the head and is simple in operation.

The Oilgear feed control pump, mentioned above, is driven by a 1-hp. motor, mounted under the pump stand, and the suction fan for removing chips and dust from the work is also driven by this motor. The fan is mounted on the stand with the pump. A ram, mounted in the center of the twin column directly under and in the center of the unit grinding head, is actuated by the Oilgear pump and feeds the head up and down.

By manipulating the control handle of the pump the head is caused to feed up and down, reversing automatically at the ends of the stroke. The length of stroke is adjustable by means of suitable trips, and the range of feed is up to ⅜ in. per revolution of the eccentric arbor. The vertical travel of the head is 28 in. and the distance from the arbor center to the apron is 11 inches.

A universal table for holding the work is mounted upon the machined surface of the bed, has an in-and-out travel of 7 in., and longitudinal travel of 36 in. The table surface is 36 x 18 in. For large work the table may be removed and the part to be ground may be attached to the bed.

Counterweights are provided for the head and are attached by chains which run over sheaves at the top of the column. The floor space required is 49 x 42 in., the height of the machine being 7 ft. The weight, including universal table and motors, is approximately 5,000 pounds.

News Section

Management Convention Brings Forth Many Progressive Ideas

The country's leading executives and employment managers to the number of more than 1,000 opened the three-day sessions of the American Management Association Oct. 29 at the Hotel Astor New York City, with the avowed intention of carrying on the association's drive to take the kinks out of Big Business. The increasing part which the selection of workers in all lines of industry is playing in business was brought to the front with the opening address of welcome by President W. W. Kincaid of the association. Elimination of expensive labor turnover, or in other words the best way of getting the employee satisfied to stay on the job, was one of the principal topics before the convention. Methods of improving the general conditions of workers in industry, the field of the plant publication in their daily lives, the best way to select workers, and kindred topics engrossed the delegates in simultaneous sessions carried on in three of the ballrooms and parlors of the Astor.

BEATTY DISCUSSES WORKMEN

A. J. Beatty, director of training of the American Rolling Mill Co., Middletown, Ohio, discussed the way his company aided its men in getting the vital facts about their work so they could appreciate it better, and Forrest W. Boswell, of the Buick Motor Co., told more than 50 house organ editors how the simpler facts of economics, intelligently applied at the factory, helped the men save money in the purchase of their homes and other expenditures.

Many of the larger industrial organizations of the country were represented at the sessions by groups of their executives, including the General Motors Corp., National Founders Association, the Conference Board of Physicians in Industry, the Society for the Promotion of Engineering Education, and the National Industrial Conference Board.

The second day was devoted in great part to the discussion of the problems of employers of labor. both factory and clerical, in obtaining the proper workers.

The report of the committee on trade apprenticeship, presented by L. L. Park, of the American Locomotive Co., chairman, took in the present-day tendency sway from laborious but profitable jobs toward the more cleanly but less remunerative "white-collar" positions.

"The number of apprentices in the trades has decreased in the past ten years," said Mr. Park, "and unless active steps are taken to train men for industry, the shortage will continue. Reports of the United States Census and the New York State Department of Education indicates that the number of apprenticeships in various trades has dropped materially in the past decade."

According to S. R. Rectanus, of the American Rollng Mill Co., interference from above does the workman no good and sometimes works for harm. It is well to bear in mind that the foreman is as fully an executive as the general manager, he stated.

At the banquet held Tuesday evening, John Hays Hammond was the guest of honor and the speaker of the occasion. His subject was "The Expansion of our Foreign Trade Through the Development of Backward Countries." He stressed the importance of going after business in countries like South America, Africa, Asia and Russia rather than spending our efforts in competition with Great Britain in Canada and the other British possessions.

LABOR TURNOVER

More than nine million workers in manufacturing industries of the country change their jobs every year according to J. D. Hackett, Industrial Engineer, who rendered the report of the committee on labor turnover on Wednesday.

The association closed its convention Wednesday. One of the speakers was Elisha Lee, vice-president of the Pennsylvania R.R., who outlined a plan for closer relationship between employers and workers.

With the growing tendency in industry toward a more general recognition of the right of the worker to have a voice in determining the conditions of his employment, he said, there develops a new anxiety on the part of the executives of large operations as to the effect this more liberal regime may have upon supervision and discipline of the working forces and upon the attitude of the minor supervisory officers.

"Out of our experience," he said, "I think I can assure them that such change as has taken place or may be expected is an improvement over anything we have had in the past. New methods have been devised of handling industrial relations, much wiser than were ever before adopted, which are in consonance with the spirit of our changed viewpoints."

Fisher Body Corp. Buys Southern Plant

John Kelsey, president of the Kelsey Wheel Co., has confirmed rumors of the sale to the Fisher Body Corp., of a portion of the Kelsey interests in Memphis, Tennessee.

The wheel division will be retained by the Kelsey company. The property sold consists of 45 acres of land, a double band saw mill with a capacity of fifty million feet of hardwood lumber per year; dry kilns, storage for approximately seventy-five million feet of lumber and the automobile body woodworking plant, built during 1919; this plant contains over 150,000 square feet of floor space and was so constructed that its capacity can very readily be doubled.

Mr. Kelsey stated that it was the desire of his company to limit its Southern operations to the manufacture of wheels and parts and that the acquisition of the body plant by the Fisher Body Corp. was an assurance that considerable benefit would accrue to the city of Memphis through the transaction.

Fred J. Fisher, president of the Fisher Body Corp., stated that it was imperative that the concern acquire a woodworking plant close by the lumber supply. The plant acquired from the Kelsey Wheel Co. is conceded to be the largest and most modern woodworking plant in the South and provides ample room for expansion. As soon as the necessary changes can be made to adapt the plant to the requirements of the Fisher Body Corp., Mr. Fisher stated that it would, no doubt, be continually operated at capacity. This will mean continual employment for a large number of people.

U. S. Steel Declares Extra Dividend

The United States Steel Corp., the largest industrial organization in the country, expressed its confidence in the outlook for the iron and steel industry of the country and business in general by declaring an extra dividend of one-fourth of 1 per cent on its $508,302,500 outstanding common stock. At the same time the company issued its statement of earnings for the quarter ended Sept. 30, which was much better than Wall Street had expected. The company has paid no extra dividend on the common stock since 1919.

The declaration of the extra dividend was a complete surprise to the financial district, as also was the statement of earnings, $47,053,680, which Wall Street estimated ran from $39,000,000 to $43,000,000.

Machine Tool Output in 1921

Machine tool manufacture during 1921 was at a rate less than one-fourth of the capacity of the industry. Had conditions been such as to make possible the maximum output, machine tools to the value of $291,773,840 would have been manufactured in that year. Instead, the value of products at the 348 plants engaged in such manufacture was $67,729,362, or 23.2 per cent of the possible output. The figures have just been made public by the Bureau of the Census. They were compiled as a result of recommendations by the Committee on Census Schedules created at a conference of trade associations, which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

Milwaukee Reports Business "Spotty" But of Good Volume

Business among metal-working machinery manufacturers and dealers as well has become more "spotty" in the past few weeks, yet it is a matter of considerable encouragement that the volume nevertheless is well maintained. Makers of milling machines are working at the average capacity reached earlier in the year, and while these interests find the bulk of orders coming from a relatively few large buyers, they appear satisfied at being able to hold their own as well as they are doing. The principal orders have been coming from the automobile trade, and usually where a fairly steady buyer has dropped out of the market, another comes in for one or a few items to compensate for the vacancy.

The competition offered new machinery by used equipment is strong at present, although the pressure is by no means as severe as during the period when war tools were thrown upon the market in large quantities, almost without regard to price. The plethora of used tools is largely a local matter, for there has been much liquidation of large shops, which is still going on.

Shops in the market for tools consist mainly of those that desire to replace present equipment with machinery that will do more work at less cost and with fewer hands. This trend has brought about the condition where special designs are in much better request than the standard types. The cost of special machines naturally is considerably higher than than of standard designs, yet a manufacturer desiring the more efficient and advanced designs seems to be willing to pay the extra charge. The trouble is that there are not enough buyers of this class and too few customers for standard machines as well, to keep production schedules on a fairly even level.

A heavy demand for hydro-electric generating equipment is believed to be in the foreground as the result of the continuance of water power development in Wisconsin and adjoining states, which in 1924 is expected to reach its most advanced state in years. Several projects involving from $1,000,000 to $5,000,000 have been proposed or are under consideration. Manufacturers of hydro-electric machinery who have recently experienced some decline in advance orders in some departments of their large works express the opinion that the distribution of new water power plant orders in the next eight to twelve months will more than overcome the loss.

Fair orders are reported by manufacturers of sawmill and planing mill machinery. The best demand, however, is for high-production equipment for automobile body shops. The music industries are heavy buyers of high quality lumber for piano and phonograph cases, and veneer mills in this territory have recently purchased new equipment to meet the increased demand for panels.

Railroads Active in New York Market

Several excellent lists have been sent out during the week by the railroads of the East and the New York dealers of machine tools have been greatly encouraged not only by the inquiries, but also by the sales that have been consumated in this direction. The Baltimore and Ohio R.R. recently issued a list and some small buying has already resulted it is reported. Other railroads, such as the Delaware, Lackawanna and Western and the New York Central were in the field during the past week with orders.

Speculation upon the actual total for the year in the automobile production was the topic of interest to machine tool dealers in the Metropolitan district. It seemed to be the opinion that it would fall short of the four million mark, but by a small margin. Sales to Eastern automobile builders have been steady during the past week and fairly satisfactory.

The note of optimism in the speech made by Judge Gary at the meeting of the American Iron and Steel Institute and the subsequent underscoring of this remark by the action of the United States Steel Corp. in declaring an extra dividend found warm approval among both machine tool builders and dealers. Mr. Gary's prediction of six months' prosperity seems to be reflected in the opinion of economists in all parts of the country. Those who take the stock market as their barometer will be encouraged in Jesse Livermore's prediction and the upward trend of prices in all stocks.

Used machinery found a good market last week and it was also an easier matter to obtain the desired machine tools. Exporting was rather lethargic except in isolated instances.

Many Inquiries in Buffalo Market

Without exception Buffalo representatives in the machine tool business report a greater volume of inquiries than two weeks ago but the dull market remains.

The inquiries have had a tendency to cause the optimistic attitude of the early part of the season to return. It had begun to wane considerably about a month ago. All dealers gave practically the same report as to inquiries and volume of business, the first very good and the latter rather dull.

The inquiries are taken by those who understand conditions in the Buffalo territory as being a good omen. Where there is such a great number of inquiries some business must follow. It indicates quite plainly that some buyers are planning for the future and that they may fill their needs soon.

This is working out as some of the far sighted ones predicted. In a city the size of Buffalo with general industry in excellent condition it could be but a matter of time before there would be a demand for machinery, conservative as the buyers might be.

Reports from the Niagara Machine & Tool Works, which specializes in the manufacture of tinsmith equipment, furnace men's supplies and the like, indicate that business in this line is good and will continue to be so for some time to come. The season started slowly, but is steadily picking up.

The Ferguson, Allen Co., Inc., which repairs locomotives, has been buying some new equipment and may buy a few more pieces, but most of the future buying is slated. This firm, however, is always on the lookout for anything that will save man-power.

The Buffalo Forge Co. reports a good steady business, particularly in the foreign department.

Building Airplanes

The Eberhardt Steel Products Co., Inc., is just finishing the last of a contract of fifty aeroplanes for the United States government. This plant continues to have plenty of work ahead in aeroplane specialties and accessories for the government and motor accessories and equipment for some of the big motor car factories.

One of the interesting trends in the machinery inquiries detected by some of the agencies is the demand for semi-special equipment; in other words, standard equipment with special attachments or features that will reduce the necessary amount of man-power.

Cranes Find Market in Pittsburg

Single items in sales of machine tools and machinery govern the market at Pittsburgh at the present time. Activity has fallen off somewhat in the past two weeks, this decrease having been felt all the more after the rush of business caused by the heavy purchases conducted by the Pennsylvania railroad three weeks ago. However, several groups of sales have been recorded, among them a 42-in. planer by the Carnegie Steel Co. for another steel corporation subsidiary, the Edgar Thomson plant at Braddock, and a motor driven band saw. Users in western Pennsylvania have also placed orders for shapers, lathes, etc., one or two tools at a time. A sale of passing interest was of used equipment, consisting of a horizontal milling and drilling machine with a 5-in. bar.

Postponed Buying

A number of prospective purchasers of material have postponed their expansion program for a while, and this delays the buying of numerous tools, among them a 7-ft. radial drill. Some prospective customers were examining tools this week, and in a number of cases tentative orders were placed, to be definitely decided in a few days. It is expected that the Westinghouse Electric & Manufacturing Co. will commence to buy on its fourth quarter list very soon, but nothing definite has been learned as to the intentions of the American Sheet & Tin Plate Co. on its inquiry for new tools.

The crane market is loosening up somewhat and inquiries are more numerous than for several months past. Not less than a half a dozen inquiries came out during the past week, some for from

one to five cranes at a time, the largest inquiries coming from steel companies in this district. One award of a 5-ton crane was made, and several are on the verge of announcement, but details are lacking at this time. In general, the machine tool market lacks interesting features such as have appeared in the past few months, but dealers are encouraged by the number of inquiries coming out in the different grades.

Business Improves in Chicago

The machine tool market in the Chicago district has improved during the week. Several dealers report sales during October as being approximately ten per cent in excess of sales during September. Dealers report a number of small sales from the floor. A dozen sand slingers were sold to the Wilson Foundry Co., Pontiac, Mich. The Lehigh Valley R.R. is inquiring for seven machine tools, and the Norfolk-Southern R.R. is in the market for one motor-driven grinding machine, a 24-in. lathe, a 6-ft. radial drill, two steam hammers of 800-lb. and 1,100-lb. capacity, a tool room lathe and a side head boring mill.

The used machinery market continues fairly active.

INQUIRIES PLENTIFUL

Inquiries for new machinery would indicate a better buying movement soon. Dealers are wondering whether the long deferred Burlington R.R. list will be closed this year. Several of the Western railroads are making inquiries for machine tools, but will probably not make any purchases until next year.

Metal manufacturing plants in the Chicago district are slowing up their operations. It is reported that several prospective purchasers of machine tools have deferred their proposed extension plans and have indefinitely postponed the buying of additional equipment.

Production of steel is declining in this district, and further curtailment will be the rule during the remainder of the year unless the carriers come into the market for heavy tonnages as is expected in many quarters. The semi-finished steel market is weak, but in some quarters a better demand is noted. Sheet bars especially are in small demand.

New England Trade Is Steady

In Hartford and vicinity there is no cessation of production and business in the industry is moving along at an even pace far ahead of that of a year ago.

In Bridgeport a chain company reports a rising demand for its products and the most gratifying indication is the tendency of jobbers to buy heavily for stock. Chain production for building material is heavier than usual to meet immediate demands and forecasts point to another great year in building activities. At this time manufacturers of agricultural chain have orders in hand to keep plants operating for four months without any more new orders. The requirements are excessive. A bigger production is to be sought shortly in silent chains for automotive equipment and this is aimed at through the further application of principle of the front wheel drive for commercial trucks. Production in this line so far in 1923 is far ahead of that of a year ago.

The trade for automatic machines of the labor saving nature is brisk, according to the reports from Hartford, New Britain, New Haven and Bridgeport. Although there is some stagnation in orders for old standard lines the better business in the group machinery types more than offsets the temporary quiet in the other line.

Steel manufacturers of this district report a good demand for steel and one of the big producers of cold rolled strip steel stated that indications are "better than favorable."

Nearly all manufacturers report 1923 business is now ahead of 1922's for twelve month, so with two months to go and a favorable tone indicated the prospects are propitious.

Canada Continues to Show Improvement In All Industries

The general industrial and commercial situation throughout Canada continues to show signs of steady and gradual improvement, the advancement being mostly along lines favorable to the machine tool industry. Metal working plants are increasing their output, which has been carefully curtailed to prevent over-production, and buying is on a broader scale. Dealers report that the iron and steel market is now somewhat more settled and better business is expected in the very near future. The Hamilton plant of the Steel Co. of Canada is working at close to capacity and continued activity is reported from the British Empire Steel Corp. at Sydney.

T. A. Hollinrake, president of the A. R. Williams Machinery Co. recently stated that competition was very keen but nevertheless, the last two or three weeks had seen an improvement in machinery sales.

Winter lumbering operations are likely to be much more extensive than last year. Japan has requested British Columbia lumbermen to bid on thirty million feet of lumber for Spring delivery. The September statement of the Canadian National Railways shows net earnings in that month to have been $1,845.970, an increase of $152,-557 over the same month last year. The country's total trade for the twelve months ending September shows an increase in imports of $170,000,000, and in exports of $204,000,000. During the twelve months Canada brought from the United States $614,000,000 worth of goods compared with purchases valued at $154,000,000 from Great Britain. The net increase in purchases from the United States during the twelve months was $122,000,000.

United States firms continue to acquire branch works in Canada. Motor car manufacturers have, as a group, probably established stronger branch factory connections in Canada than any other class of manufacturers. The tendency is toward the manufacture in Canada of a greater number of parts entering a motor car. A larger number of new factories are being established in Quebec province than during any period since the beginning of the great war. The majority are branch works of United States firms.

The annual report of the National Steel Car Co. shows that a deficit of $79,000 in 1922 was turned into a profit of $142,000 this year. During the year some $20,000 was spent in betterments to plant equipment. Orders on hand will keep the plant running until the end of November, when it is hoped further railways orders will be placed.

One of the most important recent developments in the industrial field has been the purchase by the Canadian Vickers, Ltd., of the stock, plant and business of the Phoenix Bridge & Iron Works, Ltd.

Elecrical Machinery Output in 1921

The manufacture of electrical machinery, apparatus and supplies during 1921 was at a rate only slightly more than one-half of the capacity of the industry. Had conditions been such as to make possible the maximum output, electrical machinery and apparatus to the value of $1,469,378,706 would have been manufactured in that year.

Future Bright for Detroit Trade

Brisk competition among the automotive plants in an endeavor to outrace one another in the contest for quantity production and an intangible feeling of optimism for the coming months indicates a continuation of the present industrial prosperity in Detroit and vicinity.

New quantity records are being established in some of the leading automobile factories of the city, and all weekly, monthly and seasonable marks are being rapidly superseded by manufacturers who are convinced that the best way to get their share of the market is to get on the ground first.

Leaders in the machine tool industry are not at all skeptical of the temporary lull during the past week in the placing of sizeable orders for new machinery and tools.

October, advance reports lead one to believe, was one of the most prosperous periods in Detroit's commercial and industrial life.

Building permits, new construction, addition to plants and warehouses and announcements of new undertakings give evidence of an underlying belief that Detroit will not meet a business slump.

As a token of the future, leaders point to the steady, slight rise in employment figures for the past several weeks. Figures announced by the Employers' Association show that for the week ending Oct. 30, 214,555 were employed. This is an increase of 277 over the figures of the previous week.

Railroad Lists Out in St. Louis

The railroads in the St. Louis district continue to buy as they have during the past several months, for pressing needs only, but some of them have put out inquiries relative to the prices of machine tools to be included in their budgets for 1924. These inquiries which began about three weeks ago have become heavier during the past two weeks.

The oil fields of the Southwest continue idle with the looked for re-opening deferred now until after the first of the new year.

However, the general business condition of this territory is very favorable. Railroads report an increase in car loadings for the first week of October in excess of the same period in September, the cotton and tobacco fields of the South are marketing their products at good prices and few price reductions in any line have been noticed. The demand for skilled mechanics has fallen off somewhat and in some grades a small surplus has resulted.

Collections show a slight improvement over September.

New projects of public utilities which are contemplated should provide the means for the sale of machine tools. One of these improvements is the construction of the new city waterworks at Howard's Bend on the Missouri River for which an ordinance appropriating $1,250,000 for construction of engine pits and intake towers was recently introduced into the Board of Alderman.

Members of the machine tool trade feel that there will be a more active demand for their products after the first of the New Year.

New York University Has Aviation School

After an exhaustive study of the field of aviation in the United States, New York University has inaugurated courses in aeronautical engineering and industrial aviation in its College of Engineering in New York City. The establishment of these courses is part of a plan to advance the study among the American youths of the designing and utilization of commercial airplanes and to develop among college students a body of highly skilled aeronautical engineers. Many men well known in the field of flying are patrons of the college and it has received the hearty approval of President Coolidge and members of the present cabinet.

Packard Has Good Year Report Shows

The Packard Motor Car Co. reports gross sales of $55,670,464 for the year ended Aug. 31, 1923, which with the exception of the boom year were the largest reported in the history of the company. Prices for motor cars in 1920 were higher than at present, so that the sales reported for the last fiscal year resulted from a record in the number of cars sold, which was 21,571. In the previous fiscal year the company reported gross sales of $37,988,498.

After payment of all operating expenses, interest and taxes, and the setting aside of a reserve of $2,000,000 for contingencies, the company reported net profits of $7,081,878 available for both classes of stock, against $2,115,828 in the previous year. After allowing for dividends on the preferred stock, the profits for the last fiscal year were equal to $2.54 a share on the 2,377,020 shares of common stock of $10 a share par value outstanding, against 90 cents a share earned on the 1,188,510 shares of common stock in the previous year.

Ready Sale for Ships That Are Scrapped

There is lively bidding for the naval vessels that are being scrapped in accordance with the treaty limiting armament. Among the ships that are to be cut up and sold as scrap are a number on which work was suspended prior to their completion.

The Navy Department has conducted a careful study to determine the best disposition which could be made of these ships. It has demonstrated to the satisfaction of a considerable number of contractors that it is easily possible to make profitable disposition of ship scrap. In fact a new industry has been created which is having the effect of enhancing the value of ships that are no longer serviceable. The fact that it has been demonstrated as being feasible to make profitable disposition of old ships is expected to influence the earlier retiring of ships from service.

The Shipping Board is much interested in the successful outcome of scrapping operations on naval vessels. Apparently it offers a much higher rate of return for some of its ships than could be obtained by the sale of vessels of questionable sea-worthiness for transportation purposes.

The extensive employment of steel-cutting processes also is resulting in various refinements of that art, it is declared.

Bids were received from seventeen firms last week for six of the vessels which the Navy is offering for sale.

Will Gather Data for A. S. M. E. Meeting

The Materials Handling Division of the A. S. M. E. held a meeting at the Engineering Societies Building, New York, on Nov. 2, in which plans for the further activities of the division were formulated. The economic features of the use of modern material handling equipment received attention, especially in connection with the formulas recently brought out by the division as a measure of the economies effected through the use of equipment under various conditions.

As a method for gathering data regarding the practical use of the formulas, it is planned to hold a session of the manufacturers of such equipment at the annual meeting of the A. S. M. E., at which these matters will be presented. Other methods for obtaining engineering data on the economies of material handling equipment from installations already made were also discussed.

Entire World Improved, Says Hoover

The commercial strength of the entire world, with the exception of Central Europe, has improved during the last year, Secretary Hoover declared recently at a meeting with the Foreign Commerce Department Committee of the United States Chamber of Commerce. Only two dark spots, said Mr. Hoover, loom up at all in an otherwise extremely encouraging situation. These are:

The American agricultural situation, in the disparity of prices of many agricultural products with those of other industries, more particularly in that the difficulties of the wheat farmers in certain portions of the West are considered acute.

The situation in Germany at the present time in its economic effects both on the German people and on the rest of the world. This situation contributes somewhat to the depression in American agriculture, more particularly in relationship to animal products.

General Stability

Secretary Hoover emphasized the strong industrial situation in the United States in the presence of the high rate of production, no serious unemployment, the absence of speculation and of large stocks of goods—all contributing to general stability. He pointed out that the commercial situation of the rest of the world except in Central Europe, had improved steadily during the year; that this increasing strength showed itself in increasing proportion of American exports to other quarters of Europe. At the present time 80 per cent of American exported manufactures go to other parts of the world; therefore the manufacturing industry does not feel the repercussions of Europe to the degree felt by the agricultural industry which is dependent upon Europe as the market for 75 per cent of the total of its products.

This committee, which serves as an advisory committee to the Department of Commerce, discussed a variety of foreign trade issues with Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, and other officials of the Department. The committee also considered communications on the foreign trade situation from various organizations in the export and import trade throughout the United States, and also from the American chambers of commerce in the principal trade centers in various parts of the world.

Extension Evening School at Carnegie Tech

Another development in the educational service of Carnegie Institute of Technology in Pittsburgh will be evolved this year in Tarentum, Pa., where extension evening classes will be conducted for the first time in the Institute's history. The extension evening classes in Tarentum, although an innovation says an announcement, are the first of similar developments that will be worked out in other locations in the Pittsburgh district, wherever there is a definite demand for the extension work.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THIS is written on a trip through the South and Middle West. Thus far I have visited Charlotte, N. C., Macon and Columbus, Ga., and Opelika and Montgomery, Ala. In each place many men of affairs have been interviewed. With but few exceptions they are all optimistic, but until Wednesday, when the New York stock market turned upward their optimism was querulous and qualified by an admission that they could not understand the weakness of stocks.

The doubt created by the recent droopiness of quotations on the Stock Exchange is mentioned because it is a psychological influence so important that it cannot be ignored. In the South there is but little marginal speculation in stocks or bonds; the quotations are nevertheless widely published and carefully scanned, especially by the bankers and more important business men whose views shape public opinion. Until Wednesday they feared that the persistent weakness of the stock market portended some unseen trouble, but the action of the United States Steel Corp. in raising its quarterly dividend on the common stock to 1¼ per cent has dissipated the apprehension felt, and here as elsewhere the result has been distinctly tonic.

Therefore there is nothing in sight to impair what is probably the soundest prosperity the cotton states have ever enjoyed, for while the cotton crop is very short the sum received for it promises to be the largest on record. The Government report on Friday estimated the yield at 10,248,000 bales. The estimate did not subtract a bale from the actual yield, but it caused an immediate advance of more than a cent a pound.

When to the sum received for their cotton there is added what the farmers have obtained for the other things they have learned to produce the total will probably exceed all precedents in the history of Southern agriculture. There are, of course, certain districts in which the people are suffering because they planted nothing but cotton and failed to get a crop, but in most localities the deficiency in the yield of cotton has been more than offset by what has been obtained for the tobacco, fruit and livestock produced.

The great prosperity of the Southern cotton manufacturers and the money put into circulation by the construction of new plants as well as by the sale of older plants to Northern capitalists are also factors which make for a sustained prosperity unless there shall be an outburst of speculation that carries values into altitudes that are dangerous.

One thing by which the observant traveler in the South Atlantic states will be greatly impressed is the number of automobile tourists who are already on their way to Florida. For the most part they appear to be people of moderate means but with funds enough to spend a Winter of idleness in a semi-tropical climate. Many of them explain their early start by saying that they are anxious to get to Florida in time to enter their children in the public schools there. From this it is to be inferred that they do not expect to return until the late Spring. The movement, which includes many mechanics and other wage earners with their families, must number at least 100,000 persons.

"The great prosperity of the Southern cotton manufacturers and the money put into circulation by the construction of new plants as well as by the sale of older plants to Northern capitalists are also factors which make for a substantial prosperity unless there shall be an outburst of speculation that carries values into altitudes that are dangerous. One thing by which travelers in the South are impressed is the great number of automobile tourists who are already on their way to Florida."

By those who believe that a Winter of idleness for so many potential producers is economically undesirable this hegira will not be approved, but it cannot be denied that it furnishes impressive evidence of our national prosperity and the opportunity for enjoyment which high wages have brought to the working people of this country.

Many thoughtful persons are asking, however, whether reductions in wages are not among the probabilities for the future. The cut of 10 per cent announced by the copper companies and the statement of the leading "movie" producers that they will stop work until costs come down came close enough together to attract much attention. Neither of these industries is truly barometric. But demand for steel continues low and if the companies find it necessary to reduce prices they are likely to cut wages also. Nor would it be surprising if the same temptation presented itself to some of the textile mills, for wages, in terms of buying power, are the highest in our history, which cannot be said of profits.

In the possibility of wage reductions there is no cause for pessimism, for they would level inequalities rather than reduce the general buying power. By many economists reductions in certain costs and prices are regarded as essential if 1924 is to be as good a business year as 1923 has been.

Most of the major factors in the business situation are distinctly favorable. Prices of farm products were firm last week and the Department of Agriculture points out that their purchasing power, though still at a disparity compared with manufactured goods, is the highest in three years. There is no noticeable let up in the great volume of business being transacted, as indicated by railroad loadings, bank clearings and statistics of wholesale, retail and mail order trade. Our foreign trade has been growing recently. So much construction work remains to be done that business is sure to get a great impetus from it next Spring and much more building than usual will be undertaken this Winter, for the construction people are trying hard to keep busy during the entire year round.

The ease of money is the best assurance that this work will be carried on. After several months of firmness rates are going off slightly as money is being returned to the financial centers from the agricultural districts faster than industry needs it. This augurs well for the bond market and for business enterprise everywhere. As George E. Roberts of the National City Bank points out, "We have never had a serious depression in this country which began in an easy money market. It is not conceivable that a real crisis can develop without the pressure which results from an over extended credit situation."

Hopes entertained in some quarters that the conference of experts on reparations would produce great results have been dashed by Poincare's refusal to discuss the really vital aspects of the question and little can be expected of the meeting if it is held. Premier Baldwin's denial that Great Britain contemplates a policy of inflation is the most important news from abroad. The issue is not disposed of, however, and a general election is among the probabilities.

Otherwise the European situation is not improved, but our markets continue impervious to it.

Railroad Earnings Show Gain

An increase of $25,585,000 in gross operating revenues is shown in the earnings statements of the first thirty-five Class 1 railroads reporting for September, compared with the same month a year ago. Aggregate gross was $312,744,000 in September, 1923, and $287,159,000 in September, 1922. Net operating income was $51,295,000, against $27,426,000 last year and $55,986,000 for August, 1923.

Personals

DAVID FERGUSON has been appointed chief engineer of James Cunningham, Sons & Co., Rochester, N. Y., automobile manufacturers. He was formerly chief engineer with the Pierce Arrow Motor Car Co., Buffalo.

DEAN K. CHADBOURNE, manager of the department of the Far East of the Westinghouse International Co., will sail from San Francisco, Calif., the latter part of this month visiting Japan, China, the Philippine Islands, Java, Australia and New Zealand.

H. P. ORAM is the owner and manager of the New London Cylinder Grinding & Machine Co., which has opened on Mill St., New London, Conn. He was with the United Shoe Machinery Co. at Beverly, Mass., for seven years and six years were spent with the New London Ship & Engine Co., at New London. He was also with the Automotive Specialty Co., six years.

THOMAS P. BLAIR has sold the business and equipment of the Thomas P. Blair Sheet Metal Works, San Diego, Calif., to JOHN P. BERRY.

O. A. DOLES, of the Evinrude Motor Co., has been elected president of the Sales Managers' Association of Milwaukee. VAN B. HOOPER, of the Luther Grinder Mfg. Co., was chosen secretary.

ARTHUR SELL, of the Worden-Allen Co., has been elected a director of the Milwaukee Association of Purchasing Agents and delegate to the national association convention to be held in Boston.

J. C. MCQUADE is the new manager of the Buffalo office of the Blau-Knox Co., Pittsburgh.

DEAN R. WILSON has been elected president of the Anchor Drawn Steel Co., Pittsburgh, Pa. He was formerly vice-president and treasurer of the Carbon Steel Co., Pittsburgh.

ROY MUIR ELLIS has been appointed New England sales manager of the Calorizing Co., Pittsburgh. Mr. Ellis was formerly with the Brown & Sharpe Manufacturing Co., Providence and also with the Industrial Co., Boston.

EDWARD G. SMITH, newly appointed director of pig iron sales of the Belmont Iron Works, Ironton, Ohio, was for the past six years Central States representative of the Matthew-Addy Co.

PERCY E. WRIGHT, consulting mechanical engineer has been appointed assistant sales manager of the Reeves Brothers Co., Alliance, Ohio, erector of steel tanks and oil refinery equipment. He will be in charge of its Western business with headquarters in the L. C. Smith Building, Seattle, Wash.

W. W. LEWIS and P. H. SCHAFF were elected members of the board of directors of the Falcon Steel Co., Youngstown, Ohio, at the annual meeting of the stockholders recently.

W. A. LAYMAN, president of the Wagner Electric Corp., spoke before the members of the local section of the American Society of Mechanical Engineers recently.

H. C. ARMSTRONG of Sidney, New South Wales, spent several days in St. Louis recently buying machinery for a Celotex mill.

CHARLES DAY, a director of Mirrlees, Bickerton & Day, Stockport, England, manufacturers of semi-Diesel engines, has been conferring with Toronto firms regarding the marketing of his product in Canada.

H. H. COUZENS, general manager of the Toronto Transportation Commission, has returned home after a visit to England. Mr. Couzens was away six weeks.

FRANK H. SCHUBERT, district manager of the Wheeler Condenser & Engineering Co., St. Louis, Mo., and WILLIAM G. CHRISTY, secretary of the St. Louis section of the American Society of Mechanical Engineers and formerly with the St. Louis Boat & Engineering Co., have announced the organization of the Schubert-Christy Construction & Machinery Co. with offices in the Railway Exchange Building. The firm will represent manufacturers of power plant equipment.

E. P. COREY, formerly associated with the sales department of the National Tube Co., Pittsburgh, has been appointed assistant general manager of sales for the Youngstown Sheet & Tube Co., and will direct the sales of the company's tubular products. He took up his new duties on Nov. 1.

Business Items

The Wayne Forge & Machine Co., Ltd., has been incorporated with capital of $100,000 by W. S. Watson, H. G. Watson and others, to manufacture heating appliances in Toronto.

The Follen-Lorenz Tool Works of Kenosha, Wis., has been organized by James Follen, Frederick Lorenz and Henry Lorenz, and is equipping a new shop in a two-story building on Avery St. with some new machinery and a lot of used equipment purchased at the liquidation sale of the Mitchell Motors Co. of Racine, Wis., bankrupt. The new concern will manufacture tools, dies, jigs, fixtures, etc. Pending the opening of the new factory, the concern will operate in the works of the K. & F. Manufacturing Co. of Kenosha, which recently was placed in the hands of Horace G. Maddock as receiver. The Follen-Lorenz works have arranged to take over and fulfill all contracts held by the K. & F. company. James Follen was one of the original members of the K. & F. company.

The Steel Co. of Canada conducted a "Safety Week" campaign at its plant in Montreal.

The following changes have been made by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., in its branch offices: the Baltimore office will be in the Lexington Building with D. B. Patterson in charge; the Chicago office will be in the Peoples Gas Building with W. B. Briggs in charge, the San Francisco office will be located at 16 California St. under the supervision of W. H. Ringe, and the Birmingham office will be at 507 Woodward Building with F. R. Quigley in charge.

The Beaudry Co., Inc., Everett, Mass., is occupying its new plant on Parkway and Vine St.

Incorporation has been effected by the Damascus Crucible Steel Casting Co. of New Brighton, Pa., for the past fifteen years operated as a partnership. The company is building a new plant at Hammond, Ind., which is expected to be in operation about Dec. 1. This will be in addition to the present plant at New Brighton. Grinding machines that will be used by the Damascus company have been built at Cincinnati.

Obituary

WILLIAM F. WENDT, aged 65 years, founder and former president of the Buffalo Forge Co., Buffalo, died recently in that city. An obituary will appear in a forthcoming issue of the *American Machinist*.

MICHAEL B. RYAN, aged 60 years, died recently in Milford, Conn. Mr. Ryan was the inventor of the automatic electric chain welding machine manufactured by the Automatic Machine Co., Bridgeport, Conn. He was widely traveled, having spent many years in foreign countries.

WILLIAM P. CLARK, president of the Clark Tool Works, Inc., Belmont, N. Y., died recently in that place.

WILLIAM J. LLOYD, general superintendent of the General Electric Co., West Lynn, Mass., died suddenly in Lynn, Mass.

RUTHERFORD B. BURGHER, aged 65 years, prominent for many years in the steel industry, is dead at his home, East Liverpool, Ohio. He was founder of the Kidd Brothers Steel Co., at Alliquippa, Pa., and later came to East Liverpool where he organized the National Drawn Steel Co.

Chevrolet Has Large Factory Space

Having completed its manufacturing plants in Buffalo and Cincinnati, the Chevrolet Motor Co. has acquired for the first time, plant capacity consistent with its position as the second largest producer of automobiles in the world. The company now has 12 plants with a total floor space of 5,427,393 sq.ft., or more than 124 acres. The company employs 22,675 persons. Floor space at the main plant at Flint, Mich., has been increased to a total of 1,335,000 sq.ft. The assembly plant at St. Louis has a total floor space of 1,127,800 sq.ft. The Oakland, Calif., plant has been increased to 500,000 sq.ft. and the Tarrytown, N. Y., plant now exceeds this figure by 50 per cent. A large manufacturing plant at Janesville, Wis., formerly devoted to other business of the General Motors Corp., has been changed into a Chevrolet assembling plant. This has floor space of nearly 500,000 sq.ft. New Buffalo and Cincinnati plants will add over 500,000 sq.ft. to the total of the company's manufacturing space. Increase in production from 250 cars a day in 1921 to 2,500 a day this year has been made possible.

Conditions in Alsace and Switzerland

How the big companies in Alsace are developing and their labor problems—Switzerland having a hard time getting re-established—Railway electrification

BY OUR PARIS CORRESPONDENT

THE machine and machine tool industry of Alsace undoubtedly owes its manifest importance to the high development of the textile industry of this most industrialized of the old French provinces. By this means it has become the principal center in France for the manufacture of textile machinery.

The Société Alsacienne de Constructions Mecaniques at Mulhouse and Graffenstaden, the Société Schlumberger at Guebwiller and other plants notably at Guebwiller and Thann are equipped in a way which will enable them to meet any normal demands upon them for textile machinery, not only by the imposing industry of Alsace itself, but all France and to a very notable extent for export as well.

To cite two examples in detail:

The Société Alsacienne de Constructions Mecaniques alone, with its plants at Mulhouse, Graffenstaden and Belfort, employs 15,000 workmen with a most modern equipment. The plant at Mulhouse dates from 1826, founded by André Koechlin. Its product may be divided into these general classes: textile machinery, heavy machines and tools, electric motors, dynamos, turbines, transmission lines, and power station equipment in general. The company also manufacturers locomotives in its Graffenstaden works and at Belfort, also specializes in machinery for the chemical industries.

Large Companies

The Schlumberger company at Guebwiller dates from the time of Napoleon I, at which epoch were produced spinning machines for an affiliated industry belonging to the family. Finally the construction of such machinery for others came to be the pre-occupation of the plant and by the last quarter of the last century the output was conceived from the raw material to the finished product, a progression which has kept pace with the times since. The present output comprises most varieties of wood and metal working machinery as well as special textile machines which have come to be known by reputation throughout the world. The principal plant at Guebwiller suffered greatly from bombardment during the war, but has since been rebuilt and is in full operation.

In all some 25,000 workmen are employed in that branch of the industry devoted to textile machinery, with an annual production that reaches the value of 100,000,000 francs.

Other chief lines of output are stationary steam engines, turbines, locomotives, boilers, cranes, bridges, electrical machinery and its equipment appliances, etc. For the most part these plants are self-contained, having their own foundries. The foundry industry, as distinct in itself, is important, the chief units being located at Saverne, Mulhouse, Guebwiller, Graffenstaden, Belfort and Niederbronn.

The production of machine tools and smaller hand tools are specilized in plants at Strasbourg, Saverne, Mutzig and Molsheim. Heavy hardware is centralized at Mutzig and the stove industry is chiefly at Niederbronn, Saverne and Strasbourg. Building hardware—locks, hinges, fittings and steel safes are produced at Strasbourg and Mulhouse, while wire nets in iron, steel and brass are produced at Sélestat and Mulhouse. Cutlery is specialized at Klingental. The automobile industry flourishes at Strasbourg (Mathis) and Molsheim (Bugatti).

Obviously all this output, a decade ago of German parentage, is today accounted French. It enters France without paying duty and is naturally crowding the French manufacturer in competitive lines, also the American exporter to France where the lines cross or touch. Furthermore the bulk of this Alsacian product is just so much more added to that of France in home and export markets, accounting for a not inconsiderable portion of the 12,207,000 francs in value of machines and tools exported to the United States during the first six months of the present year. For the same period in 1922 the figures were 7,228,000 francs only. The increase in a single year is approximately 70 per cent, a fact which is significant, though it may mean much or little.

> "Alsace, like most other districts of Europe, is passing through an economic and industrial crisis. Here it is largely a problem of labor and the recruiting thereof in accord with laws in force in re-annexed Alsace. The question is one which deals with what is known as the 'infiltration of German labor.' With local manufacturing plants a certain control and supervision is possible, but perhaps not always carried out rigidly."

The Difficulties in Choosing "French" Workmen

Alsace, like most other districts of Europe, is passing through an economic and industrial crisis. Here it is largely a problem of labor and the recruiting thereof in accord with laws in force in re-annexed Alsace. The question is one which deals with what is known here as the "infiltration of German labor." With local manufacturing plants a certain control and supervision is possible, but perhaps not always carried out rigidly. In any case as nine-tenths of the population of Alsace is German-speaking this control is bound to be inadequate when it comes to recruiting additional workers in a rush season and hardly less so with respect to the usual labor turnover in big manufacturing industries. With farm and domestic workers the conditions are the same.

The sorry condition of the worker in Germany largely accounts for this and it is a laudable enough ambition on his part to want to sell his labor for francs across the border at the rate of a hundred million marks for the franc. The acute situation in Germany these last days has but aggravated the state of affairs in Alsace in the above respect and without question all along the French bank of the Rhine there is a certain amount of contraband labor continually finding employment to the supposed detriment of home labor. This at least is the French workers' view. The employers of labor do not wholly agree, above all when they are running under full head and there is a shortage of applicants for employment, for it is to be remarked that Alsacian industry has been exceedingly busy in most lines where in other districts in France there has been periodic intermittent slowing down. The Alsacian metal working industries may be taken for granted as being a very important factor in the home and foreign trade of France and the outsider should not ignore this in the working up of his foreign campaigns, above all in the electrical field.

Conditions in Switzerland

The anomaly of economic and industrial finance, to call it by that name, in Europe is the position of the Swiss franc virtually three hundred per cent of the value of the French franc and four hundred per cent of the value of the Italian lira. It is this very crisis of high valued currency which has put Switzerland in the position where its relations with its neighbors France and Italy are even more unsatisfactory than they are with the world at large. Swiss industry is at the lowest production ebb known since business statistics have been scientifically recorded, employment in many lines is at a like low level and the eight-hour law has done nothing to help the situation—indeed Switzerland, being a high-exchange country, it has worked just the other way about.

If not a country of big business Switzerland is at least a land of multifarious, highly developed industries from that of watch- and clock-making to the making of textile machinery of a peculiar excellence, besides automobiles, locomotives and electrical units and accessories, armament, refrigeration machinery and that famous specialty, files. A slowing down of trade abroad, a reduction of the buying power of the currencies of many of the low exchange countries of Europe and the still more potent competition of Germany and Czecho-Slovakia, have been steadily stagnating Swiss manufacturing industries for the past thirty months.

This by no means indicates that Switzerland is lying down on the job. When an order for textile machinery or spring knitting needles, in competi-

tion perhaps with a long delivery date from elsewhere is in sight, Swiss manufacturers are only too eager to bid and usually secure a fair share of such business. Only these last days we learn of a Swiss company of four million francs just organized to aid in the development of industries and trade at home and abroad, and almost at the same time of a power station being built in Dahlen, Latvia by Swiss engineers, and the statement that within two years time Switzerland, so far as her railways are concerned, will have become the first completely electrified country in the world, incidentally saving its present yearly expenditures abroad for coal.

Direct Electric Route

Appropos of the electrification of Swiss railways it is pertinent to mention that when this has been entirely brought about as well as the newly conceived German electrified line from Hamburg to the Swiss frontier it will mean that by way of the Saint Gothard tunnel—one end in Teutonic Switzerland and the other end in Italian Switzerland, with the co-operation of the Italian railways to Genoa, Germany will have direct electric railway communication with the Mediterranean. The fear of the French is that this combination will throw Switzerland's business to the Italian port to the detriment of Marseilles and Cette in France, which latter during the war was practically a Swiss seaport.

Recently France, the Orleans Railway in particular, one of the seven great trunk lines, has been purchasing electric locomotives in Switzerland. The Brown-Boverie Co. of Baden, Switzerland, has under construction for this company two electric locomotives of 4,000 hp. capable of speed of 130 kilometers per hour. The Brown-Boverie affiliated companies at Secheron and Soleure in Switzerland are at present working entirely on behalf of the Swiss Federal Railway on its electrification scheme.

Other Rail Improvements

The Zurich Oriental Bank is co-operating with British interests for the construction of railways in Anatolia, the reconstruction and equipment of 1,440 kilometers which were destroyed during the Greek occupation and 1,900 kilometers of new line, of which a considerable portion of the equipment will be furnished by Switzerland.

The Swiss engineering industry, after the manifest compression of the last three years, appears to be recovering somewhat as is shown from the first six months exports of engineering products in 1923, that reached 71,000,000 francs. Those branches which are suffering the most are locomotives, agricultural machinery, milling machinery and steam engines. Those on the increase are textile machines, printing machinery and machine tools.

Government statistics published at the end of 1922 showed that there were 8,054 industrial plants in operation in Switzerland, a number like unto that of 1911, but a notable decrease from those tabulated in 1918. Significantly the greatest falling off was in that devoted to metal and wood working industries, the crisis in the clock and watch making industries alone accounting for the closing down of 250 establishments.

Pamphlets Received

Commerce of the Dominican Republic. The Pan American Union, Washington, D. C. The exports and imports of this Republic are listed as to value and quantity.

Agricultural Credit Facilities under the Federal Reserve Act. Federal Reserve Board, Washington, D. C. An explanation of how the small banks may function and how farmers may receive financial help from the Federal Reserve Board.

Labor Legislation of 1922. U. S. Department of Labor, Washington, D. C. The various laws passed in the different states of the union that will affect labor.

Mayari Pig Iron. The Bethlehem Steel Co., Bethlehem, Pa. A well bound book describing Mayari pig iron which is termed "a natural nickel-chromium alloy iron for making high grade castings." This is publication No. 26.

Industrial Plants. Charles T. Main, 200 Devonshire St., Boston, Mass. Volume No. 3 contains many illustrations of industrial plants where Mr. Main and his associates have been engineers. There is a great variety of products made in the plants shown.

Year Book of the Merchants' Association of New York. The Merchants' Association of New York. Woolworth Building, New York City. This book contains 394 pages of text in which the annual reports of various committees, the aims and objects of the association, the list of members and other data, are to be found.

Fourteenth Census of the United States. Department of Commerce, Washington, D. C. The number and sex of occupied persons in the United States.

Fourteenth Census of the United States. Department of Commerce, Washington, D. C. The age of occupied persons in the United States.

Foreign Commerce Handbook. Foreign Commerce Department. Chamber of Commerce of the United States, Washington, D. C. In this handbook a large number of sources of information, especially interesting to those who are engaged in or contemplating foreign trade, are grouped under alphabetical headings. Consular, postal and legal regulations are covered, together with matters of export finance and a variety of other topics. In a few pages at the back of the book are noted some of the foreign trade topics on the program of the Foreign Commerce Department for the coming year.

Warehousing and Transportation Economies in Distribution. The Chamber of Commerce of the United States, Washington, D. C. This pamphlet is prepared by the Domestic Distribution Department and contains valuable information on the subject.

Trade Catalogs

Engines. The Fulton Iron Works Co., St. Louis, Mo. This is a large catalog in which are illustrated and described all sorts of Fulton-Diesel engines in power plants where they are used.

Molding Machines. The Adams Co., Dubuque, Iowa. Labor-saving equipment for the foundry in the line of molding machines and flask equipment is to be found illustrated and minutely described in this booklet. Specifications for various foundry equipment are also included in the text.

Oxygen. M. Keith Dunham, 110 S. Dearborn St., Chicago, Ill. "Oxygen from the Air" is the title of this well bound booklet in which are described by text and illustrations the uses of oxygen and the production process by the Oxeco method.

Welding and Cutting Equipment. The Torchweld Equipment Co., Chicago, Ill. This catalog covers the complete line of oxy-acetylene welding and cutting apparatus made by the company. It also contains cross sectional views of equipment with detailed explanations.

Portable Planers and Key-Seaters. The Morton Manufacturing Co., Muskegon Heights, Mich. This is bulletin No. 2 with general specifications of the two products and general text about both of them.

Gasoline Handling Tanks. S. F. Bowser & Co., Inc., Fort Wayne, Ind. Various receptacles and methods of dispensing oils and gasoline in plants are shown by illustrations, drawings and text. An explanatory note in the booklet states that this is the most complete catalog ever published on the subject.

Drawing, Blanking and Forming Dies. The Kinite Co., Milwaukee, Wis. Twenty-four pages of text and drawings describe fully the products of this company. Letters from satisfied users are reproduced.

Motors. The Reliance Electric & Engineering Co., Cleveland, Ohio. Type-T heavy duty reliance motors for direct current are fully described and illustrated in this Bulletin No. 2014. Tables of ratings and diagramed illustrations are also included.

Tachometers. The Bristol Co., Waterbury, Conn. The many different styles for the various uses in factories of this company's products are shown in Bulletin No. 317 that has recently been issued.

Air Hoists and Elevators. The Whiting Corp., Harvey, Ill. The uses of air hoists in most factories with tables of sizes are illustrated in this booklet. Trolleys, pulleys and other accessories for hoists and elevators are also described.

Hydraulic Riveters. The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. A folder showing the hydraulic riveter, a table of specifications, and some terse descriptive matter has been issued by this company.

Air Compressors. The Sullivan Machinery Co., Chicago, Ill. Bulletin No. 77-G with full details regarding the Sullivan "WA-6" air compressors and parts has been issued.

Electrocator. The Hansen Electrocator Co., 80 Boylston St., Boston, Mass. This new precision instrument is described in a six-page folder. Its many virtues are set forth by the manufacturer with diagrams and drawings illustrating the new instrument.

Data Sheets. The Lees-Bradner Co., Cleveland, Ohio. Loose-leaf data sheets covering mathematical data relating to gearing together with considerable matter explaining and describing the operation of the Lees-Bradner gear tooth grinder. Some interesting notes on helical gears are also included. Additional sheets are to be published from time to time.

Elevating Platform Truck. The Wright-Hibbard Industrial Electric Truck Co., Phelps, N. Y. A four-page folder showing the uses of the product in various factories by illustrations and descriptive matter in which is put forth the advantages of the "Wright-Hibbard" truck.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Agency for the following is wanted in Brisbane, Australia: air compressors, fans and blowers, pulleys and transmission equipment, pumps, engineering tools and woodworking machinery. The reference number is 8003.

Forthcoming Meetings

American Society of Mechanical Engineers. Annual meeting, Dec. 3 to 6, in New York City. Calvin W. Rice, 29 W. 39th St., New York City, secretary.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Electrical Heating Appliance Co., 1721 West Adams St.—bench lathe with screw machine attachments, or screw machine, ¾ in. capacity.

Ill., Chicago—Illinois Central R.R. Co., 135 East 11th Pl., J. J. Bennett, Purch. Agt. —54 in. heavy duty motor driven lathe.

Ill., Chicago—Tinners' Machine Wks., 30 South Clinton St.—punch presses from No. 0 to No. 3.

Mich., Addison—Wiley Battery Shop, R. Wiley, Purch. Agt.—complete equipment, tools and electric press for repair shop.

Mich., Lansing—H. G. Porter, 1308 East Franklin Ave.—10 to 14 in. engine lathe.

Mo., St. Louis—R. G. Urben, Bway. and Salisbury St.—lathe, drills, gasoline pump, tank, etc., for automobile repair shop and service station.

N. Y., Binghamton—G. R. Nelson, Chenango and Eldridge Sts.—drill press, vise, tools, etc., for new garage.

N. Y., Buffalo—E. F. Neubecker, 204 Sussex St.—garage tools and equipment.

N. Y., Clayton—C. Huntington, Clayton House—tools, press, equipment and small bench tools for new garage.

N. Y., Geneva—Fisher & Payne, Carter Alley—automatic boring, tapping, milling and drilling machine tools; lathes; riveting machines, power presses, etc., for the manufacture of automobile bodies.

N. Y., Hoosick Falls — C. H. Lovejoy Chaplet Co., Inc., E. Ashworth, Mgr.—three automatic screw machines, same as Brown & Sharpe No. 00.

N. Y., Mount Vernon — Eureka Garage, 213 11th Ave., E. Herz, Purch. Agt.—tools, repair equipment, presses, etc., for proposed $60,000 garage.

N. Y., Rochester—Rochester Boiler & Tank Co., 217 North Water St., D. F. Murray, Pres.—machinery, tools and foundry equipment for expansion program.

N. Y., Utica—S. Zogby, 617 South St.—presses, tools and repair shop equipment for garage.

O., Columbus—Jewell-Bassett-Jewell Co., 246 North 4th St., W. S. Jewell, Jr., Mgr.—grinding machine and lathe, about 20 in., for service station.

O., Toledo—W. B. and J. Boice, 1730-32 Norwood Ave.—machinery, machine tools, lathe and equipment for proposed machine shop.

O., Toledo—E. O. Skelton, 4403 Willys Parkway—drill press, emery stand, tools and equipment for garage.

O., Canton—Timken Roller Bearing Co., Dulber Ave., S. W.—roller bearing machinery for proposed $250,000 factory.

Okla., Commerce—M. L. Morgan, Box 265 —lathe, emery stand, wheel and belting for machine shop and garage (used preferred).

Okla., Commerce—R. Sanders—drill press and lathe for garage (used).

Pa., Altoona—W. S. Lee, 1309 7th Ave.—equipment, tools and drill press for garage.

Tex., Cleburne — J. A. Taylor — 20 in. shaper for machine shop.

W. Va., Huntington—J. J. Weiler & Sons, Robson-Prichard Bldg.—electric drill for fabricating steel; stiff leg derrick and hoist; overhead crane for drop body.

Wis., Ogema—A. Struve—automobile repair machinery, tanks and pumps for proposed garage and repair shop.

Ont., Ottawa—Ottawa Electric Ry., 248 Albert St., F. D. Burpee, Supt.—garage equipment.

Que., Quebec—Z. Beaudet, 18 Champlain St.—lathe for garage.

Que., Quebec—A. Morin, 106 St. Patrick St.—small lathe and general garage tools.

Machinery Wanted

Ala., Fairfield—Rushton Corp.—ice making machines for proposed $152,000 ice factory.

Ala., Montgomery—Southern Cabinet Co., 601 McDonough St.—lathe, planer, cutoff saw and rip saw.

Ala., Selma—Central Alabama Lumber Co.—machinery, including saws, planers, belting, etc., to replace that which was destroyed by fire.

Conn., Bridgeport—E. F. Constr. Co., 78 Wells St.—portable sawing outfit.

Del., Dover—State Highway Dept.—receiving bids until Nov. 21 for one 20 ton platform scales.

Ill., Chicago — Chicago, Indianapolis & Louisville R.R. Co., 608 South Dearborn St., J. H. Liebenthal, Purch. Agt.—one 300 cu.ft. air compressor and one 5 ft. radial drill.

Kan., Galena—B. F. Draper, 119 Main St. (cabinet maker)—electric power wood lathe, Universal saw and belt sander (used).

Kan., Galena — Galena Evening Times, Main St., A. S. McNay, Purch. Agt.—Miller saw and trimmer; Miller feeder and job press (used).

Kan., Leavenworth—The Times, 4th and Shawnee Sts.—16, 20 or 24 page Duplex, Hoe, Simplex or Goss newspaper press.

Ky., Louisville—Hellmueller Baking Co., 434 Baxter Ave.—equipment for proposed $70,000 bakery.

Md., Ocean City—T. D. Mason—mechanical equipment for steam laundry.

Mass., East Brookfield—Daniels Mfg. Co. —narrow horizontal cloth dryer machine that will dry from 27 to 30 in. wide.

Mich., Addison—H. S. Van Etten—complete blacksmith shop equipment, to replace that which was destroyed by fire.

Mich., Blissfield—G. J. Schultz—machinery and equipment for proposed factory for the manufacture of small automobile parts at Adrian.

Mich., St. Joseph—Auto Specialties Mfg. Co.—20 ton melting furnace for proposed $70,000 hard iron cleaning department building.

Mo., Independence—S. Swihart—shoe finisher, leather stitcher, shafting, belting, pulleys and bearings.

Mo., Joplin—T. Hughes, 1206 West 6th St.—belt driven bread wrapper, belting, dough mixer, pulleys and hangers for bakery.

Mo., Joplin—Kansas Exploration So., c/o St. Joe Lead Co., R. Blanke, Purch. Agt.—sludge tables, belting, pulleys, hangers, bearings and shafting for proposed $60,000 concentration plant.

Mo., Kansas City—G. H. Dickson Mfg. Co., Hotel Lafayette, 1205 Troost Ave. (manufacturer of tools and dies)—bench press.

Mo., Kansas City—F. B. Hornung, 3030 Main St.—multi-color job printing press.

Mo., Noel—Noel Bakery—one 1½ bbl. belt driven dough mixer, also belting.

N. Y., Batavia—G. M. Hopkins, 31 Lyon St.—machinery and equipment for new plant for the manufacture of specialties.

N. Y., Bath—E. L. Green Knitting Mills (manufacturer of outer knitted garments)—machinery and equipment for new plant.

N. Y., Binghamton — Noyes Comb Co., Water St., J. K. Noyes, Purch. Agt.—special machinery and equipment for proposed plant.

N. Y., Buffalo—F. Elemba, 85 Armbruster St.—equipment for bakery, ovens, etc.

N. Y., Conewango Valley—P. Nickerson, R. F. D. 1 (automobile repair shop)—electric welding outfit (used).

N. Y., Falconer—Falconer Furniture Mfg. Co., M. M. Martin, R. F. D. 77, Jamestown, Purch. Agt.—woodworking machinery and equipment for proposed plant.

N. Y., Flint (Stanley P. O.)—Flint Cold Storage, Inc.—equipment, complete ammonia type cooling system, conveyors, hangers, pulleys, etc., for proposed $200,000 cold storage plant.

N. Y., Frankfort—Acme Road Mchy. Co., G. M. Mitchell, Purch. Agt.—machinery for proposed $225,000 factory at Salem.

N. Y., Geneva — O'Malley Candy Co., Klube Block—complete candy making machinery and equipment for proposed $75,000 factory.

N. Y., Home's Cave (Central Bridge P. O.) —J. L. Casper & Son, Inc. (manufacturer of furniture)—ten roller bearing hanger boxes for 1 11/16 in. shafting to fit from point hangers, must be split type.

N. Y., Jamestown — Jamestown Case Goods Corp., E. Holmberg, c/o Jamestown Chair Co., 20 Winsor St., Purch. Agt.—woodworking machinery, and equipment for proposed furniture plant.

N. Y., Little Valley—Little Valley Bakery, E. Robbins, Purch. Agt. — complete equipment for bakery, to replace that which was destroyed by fire.

N. Y., New York—Columbia Plush Co., 39 West 19th St.—60 in. plush loom.

N. Y., Norwich — Abbott-Kohn Ribbon Co., Berry St.—looms, special machines, equipment, hangers, pulleys, etc., for proposed $75,000 addition to plant.

N. Y., Oneida — Oneida Bottling Wks., 145 Cedar St., F. Wallace, Purch. Agt.—complete machinery and equipment for bottling works.

N. Y., Pavilion — Pavilion Natural Gas Co.—gas drilling outfits and equipment.

N. Y., Penn Yan—Taylor Chemical Co.—special machinery and equipment for proposed addition to plant on Keuka Lake.

N. C., Charlotte — Hugtite Clothes Pin Co., 417 South College Ave.—rip saws, cutoff saws and lathes.

N. C., Elizabeth City—Foreman Derickson Veneering Co.—machinery for proposed $50,000 factory for the manufacture of barrels, 3,000 barrels daily capacity.

N. C., Hamlet—Chamber of Commerce—prices on machinery for the manufacture of boxes, crates and berry containers.

N. C., High Point—High Point Folding Chair Co.—cutoff saw, rip saw and planer.

N. C., High Point—Ideal Table Co.—machinery, including lathes, planers, cutoff saws and rip saws, to replace that which was destroyed by fire.

O., Cleveland—Rawson Safety Guard Co., 639 Long Ave.—spot welder (used).

O., Columbus—Buckeye Casket Co., 371 South High St., E. B. Raidon, Genl. Mgr.—woodworking machinery (after Jan. 1, 1924).

O., Port Homer—Ohio Valley Clay Product Co., E. W. Cooper, proprietor—clay working machinery for proposed $260,000 tile works.

O., Toledo—Chevrolet Motor Co., 3137-57 Maplewood St.—machinery and equipment for proposed $66,000 addition to factory.

O., Toledo—Great Lakes Refining Co., Front St.—machinery and equipment for new $150,000 refinery.

O., Youngstown — Warner Tire Service Co., 1220 Market St., S. Warner, Purch. Agt. —complete tire repairing machinery, also equipment for charging batteries.

Okla., Commerce — Elliott Electric Shoe Shop, Main St.—Landis curved needle shoe stitcher for electric power.

Okla., Sulphur — Consumers Light & Power Co.—equipment for ice plant, including ice making machinery and raw water plant.

Pa., Blairsville—Natl. Plate Glass Wks. —$2,000,000 worth of equipment and machinery for new plate glass works.

Pa., Erie — Curtis Mfg. Co., 12th and Raspberry Sts.—oil tanks and special machinery for the manufacture of milk cans.

Pa., Forty Fort (Kingston P. O.)—A. L. Parks, Wyoming Ave.—machinery and equipment for proposed addition to bakery.

Pa., Pittsburgh—Park Way Welding Co., 100 West Park Way, N. S. (welding, cutting and brazing)—open end bending rolls ¼ in. and under for 5 or 6 ft. plates; rotary shears to cut ¼ in. and under.

Tenn., Knoxville—Duncan Mchy. Co., P. O. Box 265—one rebuilt gyratory crusher.

Tenn., Nashville—Nashville Paper Stock Co., 2nd Ave. and Church St.—paper cutters and presses.

Tex., Navasota—Western Public Service Co., P. Freeman, Supt.—35 ton motor driven ice machine, etc.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—No. 2 foundry iron quoted as low as $20@$21 per ton at Birmingham. Buyers not quite satisfied that bottom has been reached in iron prices. Coke declining with pig iron. Steel bars still $2.40, with structurals at $2.50 per 100 lb., f.o.b. Pittsburgh. Steel consumers show tendency to believe that prices have stabilized at present levels. A very small amount of cutting under is reported, mostly on steel sheets. Tin plate tending upward.

Advances—Electrolytic copper advanced ¼c. per lb. Nov. 1, making a total increase of ¼c. for the week; rise due to increased domestic demand. Zinc up 5c. per 100 lb. in New York, during week. Antimony rose ⅛c. in New York and 2c. per lb. in Chicago warehouses.

Declines—Steel sheets lower in Chicago. Tin down ⅛c. and lead ⅛c. per lb. in New York. Old metals, fabricated brass and copper declined in Cleveland.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$26. 05
Northern Basic	25. 00
Southern Ohio No. 2	25. 00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2. 25@2. 75)	29. 00
BIRMINGHAM	
No. 2 Foundry	23. 00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2. 25@2. 75)	24. 25
Virginia No. 2	28. 17
Basic	25. 00
Grey Forge	25. 00
CHICAGO	
No. 2 Foundry local	25. 50
No. 2 Foundry, Southern (silicon 2. 25@2. 75)	28. 00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26. 77
Basic	26. 77
Bessemer	27. 77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4. 75
Cleveland	6. 75@7. 40
Cincinnati	7. 50
New York	5. 50@7. 00
Chicago	5. 25@5. 75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3. 00	4. 59	3. 75	4. 00
No. 12	3. 10	4. 64	3. 80	4. 05
No. 14	3. 20	4. 69	3. 85	4. 10
No. 16	3. 40	4. 79	3. 95	4. 20
Black				
Nos. 17 and 21	3. 70	4. 95	4. 45	4. 70
Nos. 22 and 24	3. 75	5. 00	4. 50	4. 70
Nos. 25 and 26	3. 80	5. 05	4. 55	4. 75
No. 28	3. 85	5. 15	4. 65	4. 85
Galvanized				
Nos. 10 and 11	4. 00	5. 15	4. 70	4. 85
Nos. 12 and 14	4. 10	5. 25	4. 80	4. 95
Nos. 17 and 21	4. 40	5. 55	5. 10	5. 24
Nos. 22 and 24	4. 55	5. 70	5. 25	5. 40
No. 26	4. 70	5. 85	5. 50	5. 55
No. 28	5. 00	6. 15	5. 80	5. 85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0,17 lb. to 0. 36 lb. per ft. Cutting charge per 100 cuts, $1. 50 to $1. 58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0. 09	50%	⅞	$0. 16	35%
⅝	. 11	45%	1	. 18	31%
¾	. 14	0%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4. 50	6. 00	4. 50
Spring steel (light) (base)	6. 00	6. 00	6. 00
Coppered Bessemer rods (base)	6. 53	8. 00	6. 55
Hoop steel	5. 19	4. 66	4. 55
Cold rolled strip steel	7. 50	8. 25	7. 25
Floor plates	5. 80	5. 66	5. 80
Cold drawn shafting or screw	4. 65	3. 90	4. 55
Cold drawn flats, squares	5. 15	4. 40	5. 05
Structural shapes (base)	3. 64	3. 46	3. 40
Soft steel bars (base)	3. 54	3. 36	3. 20
Soft steel bar shapes (base)	3. 54	3. 36	3. 20
Soft steel bands (base)	4. 39	3. 61	3. 95
Tank plates (base)	3. 64	3. 46	3. 30
Bar iron (3. 25 at mill)	3. 54	3. 36	3. 20
Tool steel	11. 00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ¼, 7.85c.; 5/32 to ¼, 7. 35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13. 37½
Tin, 5-ton lots, New York			42. 87½
Lead (up to carlots), St. Louis	6. 45	New York	7. 12½
Zinc (up to carlots), St. Louis	6. 30@6. 35	New York	6. 80

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25. 50	27. 00	25. 50
Antimony (Chinese), ton spot	9. 62½	10. 50	9. 50
Copper sheets, base	21. 25	20. 50	23. 00
Copper wire, base	15. 50	18. 25	16. 25
Copper bars, base	19. 75	21. 50	19. 50
Copper tubing, base	24. 00	26. 50	23. 00
Brass sheets, base	17. 50	21. 25	18. 75
Brass tubing, base	22. 50	26. 25	20. 50
Brass rods, base	15. 25	17. 25	15. 75
Brass wire, base	18. 00	21. 25	....
Zinc sheets (casks)	10. 25	10. 45	....
Solder (½ and ½), (case lots)	29. 50	29. 00	27. 50
Babbitt metal (83% tin)	52. 00	52. 00	42@45
Babbitt metal (35% tin)	25. 00	17. 50	18@22
Nickel (ingot and shot)	29. 00	....	....
Nickel (electrolytic)	32. 00	....	35. 00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57. 00
Hot rolled rods, Grade "A" (base)	55. 00
Cold drawn rods, Grade "A" (base)	63. 00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.50	11.00
Copper, heavy, and wire	10.75	11.00	10.25
Copper, light, and bottoms	9.50	9.00	9.25
Lead, heavy	5.75	5.25	5.75
Lead, tea	4.75	4.00	4.75
Brass, heavy, yellow	7.00	.. ..	6.75
Brass, heavy, red	8.75	9.25	8.50
Brass, light	6.25	5.00	6.00
No. 1 yellow brass turnings	7.00	5.75	6.50
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb	.. ..	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.05	1.14
Lard cutting oil (50 gal. bbl.) per gal	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	.. ..	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.50@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@5.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.0465	0.0465	0.039
Brass rods	per lb	0.1525	0.1575	0.17
Solder (½ and ½)	per lb.	0.295	0.295	0.265
Cotton waste	per lb.	.10@.13	.10@.13	.09@.11½
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.297	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	40–5%
Machine bolts up to 1x30 in.	off list	40–10%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40–10%	60%	45–5%
1⅛ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	25–10%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30–10%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	40–10%	.....	60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	30–10%	50%	40–5%
Bolt ends, with hot pressed nuts	40–10%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	60%	.....	.....
Semi-finished nuts, ⅜ and larger	55%	70%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, hex., per 100 lb. Off list	0.50	3.50	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50–10%	60%	60%
Rivets, tinned	50–10%	60%	4½c. net
Button heads ⅞-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.60	$3.75
Cone heads, ditto (net)	5.60	3.80	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Tex., Tyler—Tyler Printing & Calendar Co.—feeder unit, 12 x 18 in. with a.c. motor, also Chandler and Price press.

Va., Roanoke—Roanoke Ice & Cold Storage Co.—equipment for 100 x 130 ft. addition to ice plant.

Va., Wytheville — R. P. Johnson (machinery dealer)—brick plant, 25,000 daily capacity (used preferred).

Va., Wytheville — Rector's Laundry — mechanical equipment for steam laundry.

W. Va., Elkins — P. Williams — coal crusher, 200 ton daily capacity.

Wis., Appleton—A. Stingle Baking Co., 968 College Ave.—mechanical baking equipment for proposed $40,000 bakery.

Wis., Beloit—T. B. Goodall, 433 Broad St.—gasoline storage tanks and pumps for proposed filling station on High and Milwaukee Sts.

Wis., Eau Claire—Lange Canning Co., Mill St., G. J. Lange, Pres.—canning and conveying machinery for proposed $50,000 cannery.

Wis., Manitowoc—The city, c/o A. H. Zander, Clk., City Hall—rock crushing outfit, including crushers, screens, conveyors, etc., for city gravel plant.

Wis., Milwaukee—A. Golembiewski, c/o Gurda & Gurda, Archts., 2nd Ave. and Mitchell St.—air compressor, gasoline storage tanks and pumps for proposed $40,000 garage.

Wis., Milwaukee—A. Heath Co., 21st and Wells Sts.—mechanical oven for proposed $40,000 addition to bakery.

Wis., Milwaukee—Shellmar Products Co., 1613 Humboldt Ave.—printing presses, special color process, for proposed $50,000 printing plant.

Wis., Neenah—E. Defnet, Secy., 157 East Forest Ave.—cooling and refrigeration machinery for proposed $40,000 storage plant.

Wis., Stevens Point—Journal Printing Co., 114 North 3rd St.—presses, belting and shafting for new plant.

N. S., Stewiacke—Dickey Woodworking Mills—planing mill machinery.

Ont., Amherstburg—Canadian Glass Co., Ltd., F. G. Hoklitzell, Sarnia, Purch. Agt. —complete equipment for the manufacture of glass, etc.

Ont., Hawkesbury — Sparkling Waters, Ltd. (manufacturer of aerated waters, etc.), C. Lapierre, Purch. Agt.—bottling equipment.

Ont., Port Colborne—J. Diffen, Welland, and R. W. Wright, Dunkirk, N. Y.—brick making plant.

Que., Chapeau — P. J. Vanasse — forge, small tools, etc., for blacksmith shop.

Que., Charlesbourg — Z. Daigle — tire presser, small tools, forge, etc., for blacksmith shop.

Que., Ile aux Chats (Valleyfield P. O.)— Pure Ice Co., Ltd.—complete plant for the manufacture of ice.

Que., Montreal—Canadian de Vains Process Co., Ltd., c/o L. G. Bell, 107 St. James St.—special machinery for the manufacture of cellulose, pulp, paper, products and byproducts.

Que., Montreal—G. Fecteau, 29 Monk Blvd.—gasoline tank, pump and air compressor for garage.

Que., Montreal—Fyon & Fyon, Manon St. and Papineau Ave.—gasoline tank and pump.

Que., Quebec — A. Auger, 18 Turnbull Ave.—air compressor, gasoline storage tank and pump.

Que., Quebec—W. J. Hawkins, 21 Aberdeen St. (marble and granite)—cutting and polishing tools.

Que., Quebec—E. Poulin, 133 Dupont St. —air compressor outfit for garage.

Metal Working Shops

Calif., San Francisco—The Victor Oxyacetylene Equipment Co., 884 Folsom St., awarded the contract for the construction of a 2 story shop. Estimated cost $18,000. Noted Nov. 1.

Calif., Sausalito—C. Mason, 31 El Monte Lane, has had plans prepared for the construction of a 2 story garage on Water St. Estimated cost $45,000. R. S. Chew, Rialto Bldg., San Francisco, Engr.

Conn., Cromwell—The Warner Hammer Co. is having plans prepared for the construction of a 2 story, 80 x 80 ft. factory. Estimated cost $40,000. Private plans.

Conn., Hartford—Kinsley & Smith, 571 Main St., are having plans prepared for the construction of a 2 story, 50 x 175 ft. garage. Estimated cost $40,000. F. C. Walz, Trumbull St., Hartford, Archt.

Conn., Waterbury—P. Laskas, 1844 East Main St., is having plans prepared for the construction of a 1 story, 60 x 130 ft. garage on Meriden Rd. Estimated cost $40,000. F. L. Lauper, 16 Albion St., Waterbury, Archt.

Ill., Chicago—The Crane Co., 836 South Michigan Ave., is having plans prepared for the construction of a 2 story, 160 x 500 ft. foundry at 4100 South Kedzie St. Estimated cost $1,000,000. Graham, Anderson, Probst & White, 80 East Jackson Blvd., Archts.

Ill., Chicago—The Hydrox Beverage Co., 2400 Lake Park Ave., awarded the contract for the construction of a 1 story, 75 x 197 ft. garage and service station on Lake Park Ave. near 24th St. Estimated cost $40,000.

Ill., Chicago—D. S. Klafter, Archt., 64 West Randolph St., is receiving bids for the construction of a 1 story, 100 x 264 ft. garage at 2501-25 East 75th St. for B. Weiss, c/o Architect. Estimated cost $100,000.

Ill., Chicago — E. G. McClellan, Archt., 7441 Cottage Grove Ave., is receiving bids for the construction of a 1 story, 200 x 200 ft. garage and service station on Indiana and 63rd Sts., for V. Cunningham, c/o Architect. Estimated cost $75,000.

Ill., Chicago—Randall Bros., c/o M. O. Nathan, Archt., 123 West Madison St., awarded the contract for the construction of a 1 story, 120 x 150 ft. automobile sales room and garage at 3519 West Harrison St. Estimated cost $50,000.

Ill., Chicago—G. Sachs, 1569 South Kedzie St., and J. J. Novy, Archt., 2434 South Ridgway St., are receiving bids for the construction of a 2 story, 125 x 135 ft. garage and service station on Homan and Ogden Sts. Estimated cost $50,000.

Ill., Springfield—G. J. Kable, 417 West Monroe St., awarded the contract for the construction of a 1 story, 76 x 181 ft. storage garage on 3rd St. Estimated cost $40,000.

Ky., Louisville — The Louisville Gas & Electric Co., 311 Chestnut St., plans to build a 1 story garage and repair shop on 7th St. and Ormsby Ave. Estimated cost $40,000.

Ky., Louisville—The Louisville Taxicab & Transfer Co., 2nd and Walnut Sts., plans to build a 3 story, 140 x 200 ft. garage and office building on 9th and Liberty Sts. Estimated cost $200,000.

Mich., Detroit—The Kroger Grocery & Baking Co., 1812 Clay St., awarded the contract for the construction of a 1 story, 82 x 390 ft. bakery and garage. Estimated cost $100,000. B. H. Kroger, Florence Ave. and Eden Park Entrance, Cincinnati, O., Pres. Noted Nov. 1.

Mich., Marquette—E. W. Cork & E. J. Davitt awarded the contract for the construction of a 3 story, 72 x 122 ft. garage. Estimated cost $75,000. Noted Aug. 30.

Mich., St. Joseph—The Auto Specialties Mfg. Co. plans to build a 1 story, 100 x 100 ft. hard iron cleaning department building and a 100 x 200 ft. foundry. Estimated cost $70,000 and $100,000 respectively.

Minn., Minnesota—L. Kinsell, 604 Builders Exch., awarded the contract for the construction of a 2 story, 132 x 157 ft. garage and office building on 5th Ave., S. and 3rd St. Estimated cost $140,000. Noted June 14.

Mo., St. Louis—The Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, Mich., awarded the contract for the consrtuction of a 2 story, 25 x 60 ft. automobile factory on Union St., here. Estimated cost $20,000.

Mo., St. Louis—The Mendenhahl Motor Co., 2317 Locust St., is having preliminary plans prepared for the construction of a 4 story, 37 x 155 ft. automobile sales and service building. Estimated cost $100,000. W. P. McMahon, Title Guaranty Bldg., Archt.

Neb., Omaha—I. Goldstein, 218 South 19th St., is having plans prepared for the construction of a 3 story, 80 x 119 ft. garage on 19th and Capital Sts. Estimated cost $90,000. J. T. Allan, 224 Brandles Theater Bldg., Archt.

N. Y., Brooklyn — The Columbia Machine Wks. & Malleable Iron Co., 269 Chestnut St., plans to build a 1 story, 74 x 491 ft. machine shop and foundry on Chestnut St. and Atlantic Ave. Estimated cost $194,000.

N. Y., Buffalo—The Pratt & Letchworth Co., 189 Tonawanda St., malleable iron works, awarded the contract for two 1 story, 52 x 120 ft. and 70 x 212 ft. factories. Estimated cost $85,000.

N. Y., Geneva—Fisher & Payne, Carter Alley, plans to build a plant for the manufacture of automobile bodies on West Hamilton St.

N. Y., Mount Vernon—The Eureka Garage, 213 11th Ave., plans to rebuild its garage, which was destroyed by fire. Estimated cost $60,000.

N. Y., New York—The Stewart-Warner Speedometer Co., 551 West 52nd St., awarded the contract for the construction of an office building and service station on West 65th St. Estimated cost $400,000.

N. Y., New York—S. Young, c/o M. Rothstein, Engr. and Archt., 26 Court St., Brooklyn, will build a 1 story garage at 242 East 98th St., here. Estimated cost $60,000.

N. Y., Salem—The Acme Road Mchy. Co., Frankfort, will build a 1 story, 85 x 300 ft. factory on Railroad St., here. Estimated cost $225,000. Noted Oct. 25.

N. Y., Tarrytown—The Chevrolet Motor Co., Kingsland Pt., awarded the contract for the construction of two 3 story, 80 x 150 ft. and 80 x 80 ft. additions to its plant.

O., Canton—The Timkin Roller Bearing Co., Dulber Ave., S. W., plans to build a 2 story, 200 x 300 ft. factory. Estimated cost $250,000. This is a part of $750,000 expansion program.

O., Cleveland—The Amer. Register Co., 3618 Payne Ave., manufacturer of hot air furnace registers, awarded the contract for the construction of a 1 story, 76 x 100 ft. addition to its factory. Estimated cost $40,000.

O., Cleveland—The Globe Brass Mfg. Co., 5532 Perkins Ave., awarded the contract for the construction of a 1 story machine shop and foundry on East 55th St. Estimated cost $60,000. H. F. Schroeder, Pres. Noted Sept. 6.

O., Cleveland — The McCauley Storage Battery Co., c/o J. F. McCauley, 1060 St. Clair Ave., is having plans prepared for the construction of a 1 story, 35 x 128 ft. factory and warehouse on Chester Ave. and East 24th St. Estimated cost $40,000. Private plans.

O., Cleveland — D. J. Silverman, 3237 East 116th St., is having plans prepared for the construction of a 1 story, 72 x 113 ft. garage on Union Ave. near East 123rd St. Estimated cost $40,000. L. Skolnik, 6th St., Clair Bldg., Cleveland, Archt.

O., Lorain—The Natl. Stove Co., a subsidiary of the Amer. Stove Co., 827 Chouteau St., St. Louis, Mo., plans to build a 2 story, 100 x 220 ft. factory to double capacity of plant, here. Estimated cost $100,000.

O., Toledo — The Chevrolet Motor Co., 3137-57 Maplewood St., awarded the contract for the construction of an addition to its factory. Estimated cost $66,000.

O., Toledo—Ranson & Randolph, Superior St., manufacturers of dental supplies, are having plans prepared for the construction of a 3 story factory. Private plans.

Pa., Phila.—Fable & Co., Inc., 837 North 3rd St., awarded the contract for the construction of a 2 story, 60 x 176 ft. sheet metal factory at 510-12 North 3rd St. Estimated cost $40,000.

Pa., Phila.—T. F. Slattery, St. Girard Bldg., will soon award the contract for the construction of a 1 story, 78 x 97 ft. garage on 59th St. below Chestnut St. Estimated cost $30,000. N. Hulme, 1524 Chestnut St., Phila., Archt.

Pa., Sharon—J. Meyer awarded the contract for the construction of a 1 story, 60 x 170 ft. garage on North Main St. Estimated cost $80,000.

Wis., Markesan—W. Dehn awarded the contract for the construction of a 1 story, 60 x 100 ft. garage and repair shop. Estimated cost $40,000. Noted Oct. 11.

Wis., Milwaukee—A. Golembiewski, c/o Gurda & Gurda, Archts., 2nd Ave. and Mitchell St., is having plans prepared for the construction of a 1 story, 60 x 120 ft. garage on Lincoln Ave. Estimated cost $40,000.

Wis., Milwaukee—L. Hunt, Archt., 210 Mason St., is receiving bids for the construction of a 1 story, 60 x 160 ft. addition to garage for the Ogden Ave. Garage Co., 305 Ogden Ave. Estimated cost $40,000.

Wis., Milwaukee—Logemann Bros., 3130 Burleigh St., manufacturer of baling presses, are having plans prepared for the construction of a 1 story, 52 x 150 ft. erecting shop. Estimated cost $40,000. E. R. Liebert, 432 Bway., Archt.

Wis., Waukesha—The Thompson Malted Food Co., Riverside Dr., will soon award the contract for the construction of a 2 story, 52 x 64 ft. addition to factory and a 1 story, 50 x 100 ft. garage. Estimated cost $40,000 each. H. J. Esser, 82 Wisconsin St., Milwaukee, Archt.